PAPER TRADE JOURNAL
Title Reg. U. S. Pat. Off.

Vol. 116, No. 23 Thursday, June 10, 1943 Price Ten Cents

Will Discuss Safety to Conserve Manpower

Annual Meeting at Menasha, Wis., on June 13 will Feature Women In Industry and Absenteeism—Paper Institute Awards Degrees—Rain and Wind Hamper Several Mills—Other Industrial News.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., June 7, 1943—Safety as a wartime means of conserving manpower will be the theme of talks and discussions at the sixteenth annual Fox River Valley and Lake Shore Safety Conference Sunday, June 13, at the high school auditorium at Menasha, Wis. The presiding officer will be S. F. Shattuck, vice-president of Kimberly-Clark Corporation, Neenah, Wis., who is general chairman of arrangements.

Opening at 1:30 P. M. with a general meeting of representatives of all industries, the program will feature a panel discussion on "Women in Industry" and "Absenteeism." The leader will be Voyta Wrabetz, chairman of the Wisconsin Industrial Commission, Madison, Wis. Other participants will be Dr. Paul Brehm, Madison, director of the industrial hygiene unit of the state board of health; George F. Nuernberger, supervisor of safety and health for the Allis-Chalmers Manufacturing Company, Milwaukee; R. C. Salisbury, safety director of the state motor vehicle division; A. A. Agostini, employment manager of Kearney-Trecker Corporation, West Allis, Wis., and Henry J. Hilgers, employment manager of the Hamilton-Beach Company, Racine, Wis.

Sectional meetings will be held at 3:00 P. M. One of these will be devoted to the pulp and paper industry, and finishing and converting. It will include a sound film, "Health and Safety," and an address by J. S. Nagel, counsel for the Zurich General Accident and Liability Company, Chicago, on "New Tools for Manpower Maintenance." There will also be a panel discussion, "The Foreman's Responsibility in the Plant Safety Program." B. J. McClosky of the Hoberg Paper Mills, Inc., Green Bay, Wis., will be the leader. Participants in the forum will include: L. C. Smith, personnel director of the Thilmany Pulp and Paper Company, Kaukauna, Wis.; Martin J. Auchter, power superintendent of the Hoberg mills; Arnold Long, Bay West Paper Company, Green Bay, and J. B. Roskams, converting department superintendent of the Hoberg mills. Robert Wood of the Lakeview mill of Kimberly-Clark Corporation, Neenah, Wis., will be co-chairman of the section, and W. F. Adrian of the Badger Paper Mills, Inc., Peshtigo, Wis., will assist.

Mrs. Hazel Laedke, nurse for the Thilmany company, will be chairman of the section on industrial and public health. H. J. Kokke, of the Kimberly-Clark mill at Kimberly, Wis., will speak to this section on "The Health Program from the Workers' Point of View."

General sessions will be resumed at 5:00 P. M. to hear Colonel C. J. Otjen, Milwaukee, commander of District No. 2 of the Sixth Service Command, U. S. Army. He will speak on internal security and protection of war plants.

Institute Awards Degrees

Twenty graduates of the Institute of Paper Chemistry were awarded degrees at the commencement exercises Sunday, May 30, of Lawrence College, Appleton, Wis., with which the Institute is affiliated.

Dr. Thomas N. Barrows, president, announced that Daniel Otis Adams, Portland, Me., who received his doctor of philosophy degree, was the winner of the gold medal, awarded annually to a fourth year student of the Institute for distinguished work. His thesis was "A Study of Some Factors Influencing the Di-electric Strength of Paper."

Others who received the doctor of philosophy degree were: Cyril Delevanti, Jr., Hollywood, Calif.; Archie J. Deutschman, Jr., Chicago; Pasquale A. Forni, Lee, Mass.; Paul B. Hansen, Yaquima, Wash.; James J. Harrison, Conrad, Mont.; Edwin Loutzenheiser, Gothenburg, Nebr.; Keith W. Max, Lewisburg, Ohio; Jules J. Perot, Shreveport, La.; Frederick Schelhorn, Glenside, Pa.; Philip E. Shick, Van Wert, Ohio; John G. Turk, Hillsboro, Tex., and Robert Van Nostrand, Wauwatosa, Wis.

Master of Science degrees were presented to: Joseph C. Clark, Jr., Columbia, S. C.; John L. Gray, Phoenix City, Ala.; Arthur J. Haug, Wauwatosa, Wis.; Gary W. Jones, White Plains, N. Y.; Robert E. March, Jefferson, Ohio; Edward Martin, Houston, Tex., and Curtis S. Walseth, Clear Lake, S. D.

Rain and Wind Hit Many Mills

Torrential rains and windstorms during the last week made the power situation precarious for some

(Continued on page 18)

Now Increased Newsprint Supply is Foreseen

Announcement of Canadian Power Controller of Restoration of Power to Paper and Pulp Mills Applies to Quebec Only—Newsprint Supply Dependent Upon Pulpwood—Paper Stocks Rise.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., June 7, 1943 — Pulp and paper mills in Ontario are not affected by the announcement this week by H. J. Symington, power controller, that power taken away from the pulp and paper industry would be restored June 1. The return of power applies to Quebec only. The announcement by the Newsprint Administrator eliminating the staggering of work hours for newsprint mills was also intended for Quebec only. Something like 100,000 h. p. of electrical energy was diverted last year from the pulp and paper industry to the aluminum and other war industries.

The restoration of electrical energy to the paper mills, however, does not mean a greater supply of newsprint for Canadian and American publishers. That is governed by the wood supply and it is stated definitely that no matter how the wood supply goes, the amount of newsprint paper available to publishers will not undergo any changes until after the third quarter of the year at least. The only possible way of increasing newsprint supply is by reducing the amount of pulp which the industry has agreed to deliver to the United States and the United Kingdom. As one authority put it, according to John E. Langdon, in The Financial Post, "There isn't a ghost of a chance of this happening and even though the power and operating restrictions have been lifted, the publishers will have to be contented with the present supply of paper."

Paper Securities Move Upward

Pulp and paper issues featured this week's unlisted stock market. Most issues in this group moved sharply upward into new high ground for the year. One of the outstanding incidents in the present bubbling stock market movement is the action of the preferred and common stocks of Abitibi Power and Paper Company, Ltd. There have been sharp advances in all four groups of securities of the company, the bonds, the 7 and 6% preferred, and the common. At the present level of about 81, the bonds are given a value of around $39,000,000. The 7% preferred is valued at $275,000, the 348,818 shares of 6% preferred at over $5,000,000, and the 1,088,117 of common at almost $2,000,000—a grand total of $46,000,000.

W. G. Weston Interested in Cellulose

Additional information now available regarding the recent activities of W. Garfield Weston, the Canadian-born member of the British House of Commons and internationally-known biscuit manufacturer, indicates that Mr. Weston is tremendously interested in the future of cellulose and plastics and that he had these in mind in acquiring control of the E. B. Eddy property in Hull, Que., and in seeking control of the Booth mill adjoining the Eddy plant at Chaudiere Falls on the Ottawa River.

The company now operating the Chaudiere mills was established by the late J. R. Booth, known as the "lumber king" of the Ottawa Valley. Some years ago it extended its interests to take in the manufacture of pulp and paper products. The plant in Ottawa has a daily capacity of 65 tons of sulphite pulp and 200 tons of groundwood pulp. Production of finished pulp products includes 70 tons daily of box board and 150 tons daily of hanging paper, kraft and fibre wrapping, wax and bag papers, book paper and writing paper.

Last year sales volume increased substantially, resulting in an increase in profit before taxes, but taxes increased in similar proportion, so that profit after income tax payments was $17,200, compared with $13,023 in 1941.

Development in Paper Board Packages

An interesting development in box board packaging is reported in the packaging of Canadian dried egg powder for Great Britain. The pure kraft board specified for the 14-pound cartons and for all master shipping containers made in Canada and destined for shipment to Britain, not only serves well the primary purpose of a good container, but helps solve the paper shortage in Great Britain.

All cartons and shipping containers of Canadian dehydrated eggs bear special salvage instructions identifying the material as 100% kraft. Not only does every shipment of Canadian dried eggs provide Britain with a vital food but the containers eliminate the necessity of using valuable cargo space for an equivalent weight of wood pulp.

Much thought and scientific research went into the evolution of the two packages now used for the export of dried eggs. Britain has two major wartime uses for dried eggs—for use in the homes and public eating places and for the bakery trade. As the common unit for distributing eggs to householders was the dozen, it was decided that a five-ounce package, the equivalent to one dozen eggs, was the most suitable unit for household rationing. A large container was required for distribution to the bakery and restaurant trades. A unit equal or near to the standard 30-dozen case of shell eggs was desirable and the Canadian suggestion that this should be one "stone," the familiar British weight, or 14 pounds, was accepted. This is equivalent to about 45 dozen eggs.

Britain is Short of New Pulp

The most urgent part of the paper shortage in Britain is the lack of new pulp to mix with waste paper in making reclaimed stock. At the request of the British government a pure kraft board is used because its long fibres are equivalent to virgin pulp.

Midwest Paper Market is More Optimistic

Clarifications by War Production Board Reported Helpful in Abating Growing Pessimism—Demand for Most Paper Lines Continues Very Heavy—TAPPI Secretary at Salesmen's Meeting.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, ILL., June 7, 1943.—The Chicago paper trade ended the month of May with the hope that the list of papers termed "essential" will soon be enlarged to aid in avoiding a grave shortage of paper in the trade. Reports here indicated that paper production was off slightly during the month and the 20% withholding order has had its effect here. But local commentators are not as pessimistic as they were a week and two weeks ago. WPB clarifications have indicated that reallocations will come which will be helpful and while many lines may suffer it seems rather certain that the shrinkage of pulp will not be as general as feared.

Demand here in krafts, sulphites, books and covers and groundwoods continued to be very heavy with profits shrinking because of the narrowing margins and lack of adequate control in commodity and labor markets. Paperboard usage was increasing to the point where local box board makers are beginning to talk about rationing of boxes to the retail trade in particular. The supply of waste paper is not sufficiently heavy in the types of paper most in demand and here, again, manpower and wage factors are having a very definite influence.

TAPPI Executive At Salesmens Meeting

The western division of the Salesmens Association of the Paper Industry was honored at its recently held meeting with the presence of three leading figures in the paper and pulp technical world. Present at the noon luncheon were R. G. MacDonald, secretary of the Technical division of the TAPPI; A. E. Montgomery, vice president of the Ross Engineering Company, well known paper engineering firm, and R. J. Zaumayer, on leave of absence from the Kimberly-Clark Corporation and now chief of the War Production Development section of the Pulp and Paper Division of the War Production Board. All three had been in attendance at sessions of the Institute of Paper Chemistry at Appleton, Wisconsin.

Mr. MacDonald did the speaking honors for the trio, describing plans for the Fall meeting of TAPPI to be held in Chicago, probably on September 21, 22 and 23. He pointed out that the meeting would actually take the shape of a "War Time Conference" which would be of interest to all divisions of the pulp and paper industry. The TAPPI executive stated that the technical aspects of pulp and paper manufacturing had grown more interesting in the face of war problems and expected that both the program and the outstanding exhibits now being arranged would make the September event a highly important one to the entire industry. Burt Fisher, western division vice-president, presided at the meeting.

Salesmen Announce Golf Program

The western division of the Salesmens Association of the Paper Industry has at least three of its hoped for four golf outings all lined up according to Herman Berge, chairman of the golf committee of the SAPEYES. The first outing will be at the Park Ridge Country Club on June 18. The second event will be on July 23 at the Sunset Ridge Country Club while the August outing will be on August 20 at the Bob-O-Link Golf Club. September plans will not be made until definite decisions are made by N.P.T.A. as to its Fall meeting program here.

Women Take Paper Selling Jobs

Women are making an entrance into the paper distribution field according to word from the Cain Paper Company of Peoria, Illinois. The well known central Illinois wholesale distributors recently employed Miss Marion Galland to cover a regular sales route. Miss Galland had worked only one day when the news reached these offices—but she had sold the first two out of three customers she had visited, including one of the largest of Peoria's retail stores.

Local Men on WPB Board

N. A. Altman of the Butler Paper Company, Chicago, and S. S. Weil of Joseph Weil & Sons, Chicago, are two local members of the Paper Distributors Industry Advisory Committee appointed by the director of the Industry Advisory Committees of the War Production Board.

Fear Equal Pay For Women Principle

The Illinois Legislature goes into its final month still giving serious consideration to a bill to provide equal pay for women for work "similar" to the work performed by men. The proposal has been amended to limit the effect to only manufacturers but retailers and service industries are reported to be continuing their opposition because of their refusal to accept the fact that a statute providing equal pay for women would be definable and practicable.

Credit Men Meet in St. Louis

Chicago credit executives identified with the local paper industry in St. Louis this week attended the War Credit Congress sponsored by the National Association of Credit Men and the local hosts, the St. Louis Association of Credit Men. The Paper Products and Convertors division of the credit group held several special sessions under the chairmanship of V. C. Eggerding of Gaylord Container Corporation of St. Louis. J. M. Bireley of the J. W. Butler Paper Company of Chicago is scheduled to preside over special meetings for the discussion of credit problems as applied to the fine paper industry. The Chicago Credit Mens group has an active Paper Division and many of its members were in St. Louis from May 25 through May 27.

Hock & Co. to Distribute Escort Bond

J. Francis Hock & Co. of Baltimore, Md., has been appointed a distributor in that area of Escort Bond, a 50% new, white rag paper made by the L. L. Brown Paper Company, Adams, Mass.

Instrumentation Studies XLIV*

Penetration of papers by water vapor. Part I.

General discussion of the present status of the measurement of water vapor permeability

By the Staff of The Institute of Paper Chemistry

(Continued from the issue of April 18, 1943)

The above discussion may be summarized as follows: (1) In the testing of all light and moderately heavy papers, a tare of fixed volume equal to the enclosed volume of the cup assembly should not be used. The only appreciable error then involved in the weight determinations will be that due to change in moisture content occasioned by drift in relative humidity. (2) In the testing of heavy paperboards of stiffness so great as to indicate the use of a tare, appreciable error may arise in variation of moisture content. It would appear that nearly exact compensation could be obtained for membranes of all weights and types by employing, for each sample, a tare comprised of a testing cup closed by a specimen as similar as possible to the specimen under test. Such a tare should contain only a nonhygroscopic mass having weight and volume approximating those of the desiccant, water, or solution present in the testing unit. The use of a tare of this kind has the objectionable features of requiring an additional number of testing cups equal to the number of samples to be tested, and of requiring a considerably greater expenditure of the operator's time.

An error due to change in buoyant force which would not be compensated by the use of a tare of volume V enclosed by an actual specimen would sometimes be involved when working at high relative humidities with heavy papers and paperboard. Such an error would arise in the following way: If the relative humidity inside the cup must be at a high value (to simulate conditions of use), the test specimen will eventually take on an elevated moisture content and, as a result, will swell to bulge into or out of the cup. In consequence of the change of enclosed volume, the buoyant force will increase or decrease and, if the specimen happens to be quite impervious to air, and strong, an error of at least several mg. could be accounted for. The specimen covering the tare cup would remain flat, and hence no compensation for this error would obtain.

Mention should be made of an error which would be quite significant where the test samples are *very rigid*, and a tare employing a specimen of the paper is used. This error relates to air leakage (occasioned by atmospheric pressure change) through accidental, minute "pinholes." If there is a slight hole in the test specimen, it is possible that this would be evident from the data, in which case the results for the defective specimen could be discarded. However, an accidental pinhole in the specimen covering the tare would probably go unnoticed, and a change in buoyant force due to atmospheric pressure change would not be compensated.

In view of the foregoing discussion, the practical disadvantages of tares covered with actual specimens almost outweigh the theoretical advantages, and hence it might be recommended that tares be employed in which shim metal of extensibility nearly the same as that of the test sample be used. Where the test specimen may swell, there appears to be no convenient compensating means.

2. *Diffusion resistance of air in the testing cup.* If one wishes to place water or a saturated salt solution in the cup, an air space will exist between the specimen and the water or solution. Abrams and Brabender *(2)* have shown that the diffusion resistance of this layer of air is not always inappreciably small and that, in consequence, the relative humidity of the air in immediate contact with the inner surface of the specimen may be quite different from that intended. Where the specimen has an extremely low permeability to water vapor, the difference is insignificant or, to put it in another way, the drop in partial pressure of water vapor across the air layer would then be negligible.

If, for the sake of discussion, we assume that the rate of transfer of water vapor through a test specimen is proportional to the difference in partial pressures of water vapor at the two surfaces, then the ordinary diffusion equation may be employed. At equilibrium, the rate of transfer through the air layer is equal to that through the specimen:

$$(k_1 A_1 p_1)/h_1 = (k_2 A_2 p_2)/h_2. \qquad (7)$$

In Equation (7) k_1 and k_2 are coefficients characterizing the WVP of air and the specimen, respectively; A_1 and A_2 are the areas of transfer, and may be taken equal; p_1 and p_2 are, respectively, the drop in partial pressure of water vapor across the air layer and that across the specimen; and h_1 and h_2 are, respectively, the thicknesses of the air layer and the test specimen. Ideally, p_1, the drop in partial pressure across the air layer, should be zero so that the relative humidity of the air in contact with the specimen will be the same as the equilibrium relative humidity of the water, salt solution, or desiccant within the test cup. Actually, however, in the case of ordinary and low grade moistureproof papers, p_1 is an appreciable fraction of the total drop in partial pressure involved in the test. Truly enough, comparative tests can be made with fair reliability, since the error is dependent *only* upon the WVP of the test specimen; however, discrimination is very poor for papers of high permeability when water or salt solution is contained in the cup with the recommended spacing of 25 mm. between the water and the specimen, because most of the resistance to the transmission of water vapor from the water or salt solution to the exterior may be in the air space rather than in the sample. This is well illustrated by data on the WVP of a series of 72 samples of nonmoistureproof papers *(14)*. The actual loss in weight of cup assemblies in 3-hour periods for papers including sulphite bond,

* This report is one of a series issued as a part of the Instrumentation Program of the American Paper and Pulp Association.

rag bond, bonds and ledgers having rag-sulphite furnishes, mimeo bond, butcher's paper, offset, bleached and unbleached sulphite wrappers, several grades of kraft bag stock, several grades of book, and coating raw stock was confined between the narrow limits, 0.29 to 0.39 g./3 hr. The basis weights of these papers covered the wide range, 0.2103 to 1.3185 g./3″x3″ square (a ratio of 6.3 against the ratio of 1.35 for maximum to minimum WVP). In the work referred to, the amount of water employed in the testing cup was such as to make the thickness of air space equal to 3.9 cm., so that the insensitivity was greater than where a spacing of 2.5 cm. is used.

In the mathematical considerations of the data presented in the foregoing paragraph, which was obtained under a cooperative research with the Papermakers Chemical Division of Hercules Powder Company on the development of the Fluorescence Size Tester, conclusions were reached regarding the thickness of still air which would have a diffusion resistance equivalent to various paper samples *(15)*. The treatment of the problem starts with the differential equation of one gas diffusing into another *(16)* and leads to the equation,

$$Q = \frac{D(1/(h_1 + (h_2/f)))\ (p_{w_s}/P)}{(1 - r_0)\ (18/19)\ A\ d} \qquad (8)$$

for Q, the rate in grams per second at which water vapor leaves the cup assembly. In this equation, D is the diffusion coefficient for water vapor diffusing into air (and *vice versa*), and is equal to $0.22(T/273)^{1.75}$ (P_0/P) c.g.s. units *(17)*. The quantity (h_2/f) refers to a nonhygroscopic membrane equal in thickness to that of the specimen but having actual open channels of total area equal to a fraction f of the exposed sample area A; this quantity (h_2/f) may also be thought of as the thickness of still air space equivalent in diffusion resistance to the sample. (The actual specimen may or may not have actual channels; the equivalent, nonhygroscopic grid is merely a mathematical artifice.) As regards the remaining quantities in the equation, P_{w_s} is the partial pressure of saturated water vapor (Equation (8) was deduced for the case in which pure water is used in the cup); P is atmospheric pressure; r_0 is the relative humidity outside the cup (expressed as a fraction); A is the exposed sample area; d is the density of dry air; P_0 is standard atmospheric pressure.

Using Equation (8), the equivalent thicknesses of still air were calculated for membranes covering the wide range in WVP. These are presented in Table II. While it is recognized that ordinary papers are not moistureproof (even though sized), it is perhaps startling to find that they are less resistant to the passage of water vapor than 0.5 inch of still air. This means that most of the resistance occurs in the 25-mm. air space when ordinary papers are tested with the present recommended method using water (or salt solution) in the cup, and explains the insensitivity of the method for nonmoistureproof papers. Also, since the pressure drops across air space and specimen are

TABLE II.—STILL AIR DIFFUSION EQUIVALENTS

	Equivalent Thickness of Still Air (Approximate)
Untreated regenerated cellulose sheeting	1 cm.
Ordinary, untreated paper	1 cm.
Moistureproofed regenerated cellulose sheeting, and moistureproof paper of good quality	1000 cm.

in proportion to the respective diffusion distances, the change in relative humidity across the air space would be 2.5/3.5 or 71 per cent of the difference between the relative humidities at the surface of the water (or salt solution) and the exterior; if the external relative humidity were 65 per cent, that of the air in contact with the inner face of a specimen of ordinary paper would be 75 per cent if pure water were used in the cup. On the other hand, where a specimen having a still air diffusion equivalent of about 1000 cm. is tested, the change in relative humidity across the air space would be only 2.5/1000 or 0.25 per cent of the total difference. Thus, the effect under discussion is not important where really moistureproof membranes are tested, but should be carefully regarded in the development of a method designed to be suitable for the testing of all enveloping materials.

3. *Other sources of error.* In the literature which has been cited *(4, 5)* the reader may find a discussion of errors which may be compensated for, or eliminated by the exercise of suitable care. Such sources of error are: imperfect wax seal; failure of the seal or of the specimen itself through contraction of the specimen; moisture absorption by the wax of the seal; the "Von Schroeder effect" arising from condensation of liquid water on the inner face of the specimen when pure water is used in the testing cup and the room temperature falls slightly; area of the test specimen; insufficient elapsed time before rate measurements; insufficient speed of the circulating air over the external face of the specimen; and such self-evident sources of error as inaccurate weighing, improper control of temperature and relative humidity in the testing room or cabinet, etc.

Method Suggested for Future Investigation

In view of the fact that a considerable amount of work has already been expended on the gravimetric method, it seems logical that further instrumentation research should be directed to relatively unexplored but promising avenues of investigation. Several nongravimetric methods have been described in the literature but, in nearly all cases, the apparatus employed has been of a specialized type, not readily applicable to the simultaneous testing of several specimens in routine work. At least one nongravimetric method—namely, the *comparison method*—gives promise of being satisfactory for a more extensive investigation of WVP, even though it might not be suitable for routine work in the mill. In this method the resistance of the test specimen to transfer of water vapor would be compared with a standard of *diffusion* resistance (of which there would be several covering a wide range). The standard of diffusion resistance would be so chosen that the drop in partial pressure of water vapor across the specimen would be of the order of half the total drop across the series combination of the specimen and the standard resistance; and the relative humidities of the atmospheres at the two ends of the series combination would be so chosen that, at equilibrium, the specimen would be tested under nearly the desired conditions of relative humidity at its two surfaces.

For the purposes of discussion of the comparison method, a schematic sketch is presented in Fig. 2. A totally enclosed glass vessel is arranged to have three compartments: A, containing a saturated salt solution, S_1, is separated from B by the test specimen; C, containing a saturated salt solution, S_2, is separated from B by a glass partition containing the standard diffusion resistance, R. The middle compartment B contains an indicator of relative humidity, H. A suitable wax seal exists at W. Let the equilibrium rela-

tive humidities in the three compartments be r_a, r_b, and r_c, the first and last being determined by the nature of the salts employed in the respective compartments. The relative humidity, r_b, in the intermediate compartment will depend upon the WVP of the specimen and the resistance R of the standard diffusion resistance. At equilibrium, which exists when the indication of H is constant, the WVP is equal to the rate of transfer through the standard resistance. Calling the rate of transfer Q, we may write

$$Q = (p_b - p_c)/R \qquad (9)$$

where p_b and p_c are the partial pressures of water vapor in compartments B and C, and R is expressed in terms of partial pressure difference per unit rate of diffusion (e.g., R may conveniently be expressed as mm. of mercury per mg. per day). Partial pressure of water vapor, p, may be taken equal to $r\ p_{ws}$, where the relative humidity, r, is expressed as a fraction, and p_{ws} is the partial pressure of saturated water vapor at the temperature of test.

The WVP may be taken equal to Q multiplied by the ratio of the reference area (usually 1 mm.^{2}) to the penetrated specimen area. If it is desired to express the WVP in terms of rate of transfer per mm. difference in partial pressure, this could be obtained by dividing by $(p_a - p_b)$. It is not implied that rate of transfer is proportional to the partial pressure difference $(p_a - p_b)$, for this is known not to be accurately the case; the quotient would give the average WVP per unit pressure difference, for the stated conditions of relative humidity and temperature.

An apparatus constructed literally like that sketched in Fig. 2 would be subject to the following criticisms and comments:

1. For reasons discussed under "The Present Method," the still air spaces in the three compartments are objectionable.

2. Small, accidental air currents about the ends of the resistance tube R arising in slight convection in the compartments B and C would cause error and uncertainty in R.

3. If the volume of compartment B is large, the time for equilibration would be noticeably longer than that corresponding to negligible volume.

4. Similarly, the equilibration time is related to the surface area and volume of any hygroscopic material employed in the humidity indicator, H.

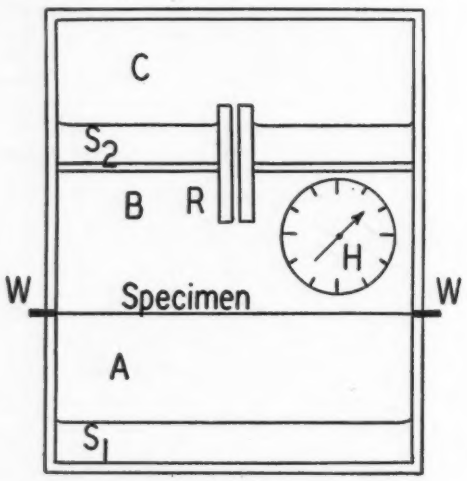


FIG. 2
Schematic Arrangement for Measurement of WVP by the Comparison Method

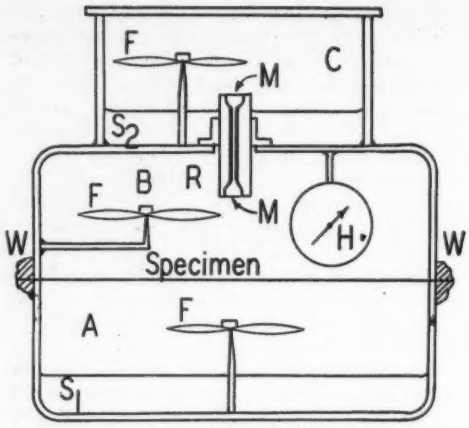


FIG. 3
Proposed Arrangement for Investigation of the Comparison Method for Measurement of WVP

5. Accuracy of the method would depend directly upon the accuracy of the indicator, H, of relative humidity. Moreover, the mechanism of the humidity indicator must not be such as to modify either the relative humidity or temperature in the process of measurement.

A readily constructed glass unit designed to meet the above criticisms is sketched in Fig. 3. With reference to this design:

1. Small, rapidly revolving fans, F, produce good circulation and mixing of the air in each compartment. Each fan is cut from a thin metal sheet, and pivotally mounted on a vertical, sharply pointed, hard steel needle. These small fans would be driven by a rotating magnetic field produced by a laminated ring of transformer iron wound with coils connected to a polyphase circuit, and arranged below a nest of testing units; in other words, the manner of drive would be essentially the same as that employed in an induction motor.

2. The inner diameter of the resistance tube, R, is flared out at each end, as shown, and each end is covered with an extremely thin, porous sheet, M. This serves to ensure that the air confined in the diffusion resistance will be still, and free of small eddy currents that would otherwise be caused by the circulation produced by the fans, F. Material for the sheets, M, is available having still air diffusion equivalents less than a millimeter, so that the resistance contributed by these stilling sheets would be a very small fraction of the total resistance, R.

3. The volume of the compartment B would not appreciably affect the equilibration time if it can be kept below 100 or 200 cc. The delaying of equilibrium due to moisture content change of the air in compartment B really depends upon the thickness of the air space in this compartment; if this thickness is not greater than a few cm., the equilibration time will depend primarily upon the nature of the test itself.

4, 5. Evaluation of the relative humidity of air confined in a small space may be effected by any one of several methods, none of which requires a disturbingly large sorption of moisture or involves an appreciable temperature change. Among these are:

(a) A hair hygrometer, comprising a short length of properly solvent-extracted human hair, fixed at one end and wrapped, at the other end, about a tiny shaft mounted in fine pivots and carrying a small pointer.

(b) A hygrometer depending for its action on the change in electrical conductivity of certain films when the relative humidity of the ambient air is modified. A new and quite promising electrical method is currently under investigation with the objective of testing its suitability in both the test under discussion and in devices for the measurement and control of moisture content of the web on a paper machine. If found to be suitable, this method would involve only a simple "plugging in" and reading from an electric meter.

(c) A micro "wet bulb" device employing a small thermocouple junction wet with a saturated solution of a salt having an equilibrium relative humidity in the neighborhood of the anticipated value; the warming or cooling of this junction (as read from a galvanometer) might enable quite accurate measurement of the relative humidity. Negligible gain or loss of moisture in compartment *B* due to absorption or desorption at the junction can be ensured by smallness of the droplet adhering to the junction. It should be possible to devise a simple means for exposing the wet junction to the air in compartment *B* only when a measurement is desired.

The accuracy of the method proposed for future study would seem to depend primarily on (1) the accuracy with which the standard resistance is known, (2) accuracy of the hygrometer, and (3) the value of the relative humidity in compartment *B*. The values of the various resistors to be employed may be determined directly by weighing the system after removal of the test specimen, the upper compartment and its salt solution. These gravimetric determinations would be free of the errors discussed under "The Present Method." To illustrate the inaccuracies associated with items (2) and (3) above, we may take as an example a case in which the relative humidities in compartments *A* and *C* are, respectively, 10 and 90 per cent. If we choose a standard resistor having a permeability comparable with that of the test specimen, the equilibrium relative humidity in compartment *B* will be in the vicinity of 50 per cent. The change in relative humidity across the resistor will then be 40 "points," and, according to Equation (9), an error of ± 2.5 per cent would be introduced in the determination of the WVP of the specimen by an error of ± 1 "point" in the relative humidity indication of the hygrometer. If, on the other hand, a large "sample variation" accounted for a relative humidity drop across the resistor of only 20 "points," then the hygrometric error of ± 1 "point" would be responsible for an error of ± 5 per cent in the WVP.

A significant advantage of the proposed method relates to the size of test specimen which may be used. Whereas the diameter of the currently employed cups and specimens is limited by the size of the pans of the analytical balance, the diameter of specimens which may be used in the proposed test is limited only by that of shallow glass dishes of feasible size; that is, it should be possible to measure the WVP of specimens having an area at least ten times that now tested.

Literature Cited

1. Abrams, A., and Chilson, W., *Paper Trade J.* 91, no. 18: 175 (Oct. 30, 1930).
2. Abrams, A., and Brabender, G. J., *Paper Trade J.* 102, no. 15: 32 (April 9, 1936).
3. Brabender, G. J., *Paper Trade J.* 108, no. 4: 39 (Jan. 26, 1939).
4. Brabender, G. J., *Paper Trade J.* 110, no. 18: 27 (May 2, 1940).
5. Carson, F. T., Natl. Bur. Standards, *Misc. Publ.* M127. August 5, 1937.
6. Water Vapor Permeability Symposium, *Tech. Assoc. Papers* 20, no. 1: 90 (1937).
7. Carson, F. T., *Paper Trade J.* 107, no. 18: 59 (Nov. 3, 1938).
8. Babbitt, J. D., *Can. J. Research*, 17A no. 2: 15 (1939).
9. Babbitt, J. D., *Can. J. Research*, 18A no. 5: 90 (1940).
10. Charch, W. H., and Scroggie, A. G., *Paper Trade J.* 101, No. 14: 31 (Oct. 3, 1935).
11. Taylor, R. L., Herrmann, D. B., and Kemp, A. R., *Ind. Eng. Chem.* 28, no. 11: 1255 (November, 1936).
12. Tressler, D. K., and Evers, C., *Paper Trade J.* 101, no. 10: 33 (Sept. 5, 1935).
13. Campbell, W. B., Forest Products Labs. Can., *Quarterly Rev.* No. 16: 1 (October-December, 1933).
14. Van den Akker, J. A., Nolan, P., Dreshfield, A. C., and Heller, H. F., *Paper Trade J.* 109, no. 21: 33 (Nov. 23, 1939).
15. Unpublished work; it is a pleasure to acknowledge the kindness of the Hercules Powder Company in releasing this information.
16. Loeb, L. B., "The Kinetic Theory of Gases." 2d ed. New York, McGraw-Hill, 1934.
17. International Critical Tables 5: 62. New York, McGraw-Hill, 1929.
18. Brabender, G. J., Proc., 1st Food Conference, Institute of Food Technologists 1: 227-235 (1940).

Roger H. Lueck Gets Honorary Degree

In recognition for "outstanding contributions in the fields of science and industry," Roger H. Lueck of Oak Park was awarded an honorary Doctor of Science degree by Carroll College at commencement exercises today at Waukesha, Wis. Dr. Lueck, who was graduated from Carroll College in 1919, is Director of Research of the American Can Company at Maywood. He is a leader in the field of canning technology and is noted for his many contributions to the canning industry.

The honorary doctorate was conferred by Dr. G. T. Vander Lugt, President of the College and a citation was read by Dr. W. L. Ray, head of the Department of Chemistry. Dr. Lueck delivered the commencement address taking as his theme "The Post-War Period; Its Challenge to the College Graduate" in which he described social and economic problems engendered by technological and scientific progress during the current war, in the post-war solution of which young college graduates must accept leadership.

O. H. Barnhill Honored

O. H. Barnhill, manager of Blake, Moffitt & Towne's Tucson, Arizona, office has been elected president of the Tucson Rotary Club. Well qualified for this position of responsibility, Mr. Barnhill has twice served on the club's board of directors during the ten years he has been a member.

He is also active in numerous other civic affairs, having just been appointed a member of the board of trustees for Tucson School Dist. No. 1. Mr. Barnhill, who attended the University of Washington in Seattle, came to Tucson in 1932 as manager of the Blake, Moffitt & Towne office. Since that time he has been a member of many civic organizations, being associated with the Tucson Chamber of Commerce, Towncats, Sunshine Climate Club, and the American Legion.

Lieut. Donkersley Gets D. F. C.

Flgt. Lieut. Harry Donkersley, former member of the staff of the Powell River Company at its pulp and paper mills at Powell River, B. C., recently received the D. F. C. and Bar from His Majesty the King.

Harry won his decorations over heroic Malta. He destroyed or damaged at least six important Axis convoy ships carrying precious supplies to hard-pressel Marshal Rommel and participated in numerous attacks on units of the Italian navy. "He showed," said the official citation, "outstanding qualities of leadership and initiative."

Obituary

William F. Mohan

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., June 7, 1943—William Francis Mohan, first vice-president of the Scott Paper Company, Chester, Pa., died on Saturday last at his home on Marple Road, Broomall, Delaware County. He was 51. He also served as a director of the firm, and was nationally known as a sales executive, and recognized throughout the paper industry as an authority on distribution. He was at one time first vice-president of the Grocery Manufacturers of America.

Born in Boston, Mass., September 29, 1891, he spent his youth there. In 1914 he entered the employ of the Scott Paper Company as a salesman, and became district manager in the Boston area. In 1922 he was transferred to Philadelphia as first divisional sales manager. From here he was transferred to Chicago in 1924 as divisional sales manager of the company in the West. Four years after he returned to Chester as general sales manager, and was elected to the board of directors in 1930. After serving for four years in this capacity, Mr. Mohan was appointed vice-president in charge of sales, and in 1939 he became first vice-president of the company.

Surviving are his wife, Mrs. Lillian B. Mohan, and two daughters, Mrs. Frank Kennedy, of New York, and Mrs. Charles M. Turville, of Drexel Hill. Funeral services were held this afternoon at 2:30 o'clock, with interment in Arlington Cemetery. The Chester plant was closed at 11 o'clock and the 1,600 employes took part in special memorial services.

James M. Hamilton

James McClintock Hamilton, retired paper box manufacturer, and postmaster of Chester during President Taft's administration, died during last week at his home, 116 West 24th street, Chester, Pa., after a long illness. He was 79.

Before entering the manufacturing business established by his father, Mr. Hamilton was associated with wild west shows and ranches of two famous westerners, Buffalo Bill (William F. Cody), and Pawnee Bill (Gordin William Lillie). For more than 40 years, he was active in the Republican organization of Delaware County, and was elected a member of the Board of County Commissioners in 1920. For a time he was superintendent of the Delaware County Home at Lima.

Mr. Hamilton was an organizer and charter member of the Chester Kiwanis Club and the Chester Businessmen's Association ,and was a past exalted ruler of the Chester Elks Lodge.

He is survived by a daughter, Mrs. Itasca H. Stevenson; four sons, Norman A., James W., Vernon A., and Gordon L.; two sisters, Mrs. John M. Broomall, widow of the Delaware County judge, and Mrs. Charles Vance, of Arrtanna, near Gettysburg.

P. W. Steinbecker

P. W. Steinbecker, for many years Michigan and Ohio representative of the Harvey Paper Products Company of Sturgis, Mich., died suddenly on May 24.

Perc, as he was known throughout his territory, passed away in a Detroit hospital after an illness of only a few days. Until a short time before his death, it was believed he was on the road to recovery and he had expected to be in his territory again in the near future.

For the past 19 years, he had represented the Harvey Paper Products Company, joining that concern soon after it first entered business.

Funeral services were held in Detroit on May 27, with interment in White Chapel Memorial Park near Detroit.

Cornelius M. Kenealy

Cornelius M. (Fred) Kenealy, 72, foreman at the Hollingsworth & Vose Paper Company, died June 3 at his home, 225 Washington street, Norwood, Mass.

Mr. Kenealy was born and educated in Canada and came to this country in his early 20's. He was a member of Bishop Cheverus Assembly, fourth degree, K. of C.; Norwood B. P. O. E. No. 1124, and a charter member of Walpole K. of C.

He leaves a son, Fred J. Kenealy of East Walpole. Funeral services were held at his home June 5, followed by a requiem mass at St. Catherine's Church.

Andrew D. Wilcox

Andrew D. Wilcox, 78, retired salesman for the R. A. Wilcox Paper Company, died suddenly May 30 at the home of his sister, Mrs. Frank Albro, 288 Lincoln avenue, Fall River, Mass. He was a member of the Herrick class of the First Baptist Church, that city.

He leaves two sons, Frank L., of Coral Gables, Fla., and Alan L., of Darling, Pa., a daughter, Mrs. James L. Brown, of Denver, Colo., 11 grandchildren, two great-grandchildren; a brother, William B., of Swansea, Mass., and his sister, Mrs. Albro.

Cleveland Container Co. Busy

[FROM OUR REGULAR CORRESPONDENT]

OGDENSBURG, N. Y., June 7, 1943—Two shifts have been placed in operation at the Cleveland Container Company on Main street and production of containers is being carried on with good speed. The firm is now employing about 110 workers in its three plants here and additional hands are being taken on daily. F. W. Walker, president of the concern, and James Mathewson, engineer, were here during the past week supervising the first production of containers. Equipment was assembled in recent weeks and every effort will now be made to meet the backlog of orders that has piled up. During his visit Mr. Walker inspected all production units and expressed satisfaction with the progress that has been made. He said that the only factors hampering expansion are the difficulties of obtaining necessary equipment. The old Ogdensburg Silk Mill, recently leased, is now in operation turning out a large government order. As fast as the machinery is installed more workers will increase the force, according to the management. It was stated that as soon as the necessary machinery has been installed the concern's original product of boxes will be increased as rapidly as possible. The company already has orders for 1,000,000 tissue cores a month and 25,000,000 fibre tubes but as these are for private concerns they will be held in abeyance until sufficient machinery has been erected to care for them.

H. E. Gould Buys Rheinhold Paper Co.

Two of the finest paper houses in the Metropolitan area will henceforth be headed by a well-known paper executive—Harry E. Gould. For many years, president of the Aldine Paper Company, specializing in special papers, Mr. Gould has purchased the old established Reinhold Card and Paper Company. The two paper companies will be conducted entirely separate and independent of each other.

The Aldine Paper Company will continue as specialists in special papers; whereas, the new firm of Reinhold-Gould, Incorporated, will stock and distribute an extensive line of mill brand papers for the printing and allied industries.

Reinhold-Gould, Incorporated are distributors for

HARRY E. GOULD

many of the outstanding mill brand lines in this country, such as Hammermill papers; Whiting Plover's rag bonds, ledgers and light-weights; Cantine's coateds; International Paper Company's Saratoga and Ticonderoga book and text papers; Mead's processed coateds; Wheelwright papers. Also, standard grades of American Writing Paper Corporation, Chemical Paper Manufacturing Company, Riegel Paper Corporation, Standard Paper Manufacturing Company, United States Envelope Company and many other leading mills.

Mr. Gould will shortly announce plans for enlarging the present personnel nucleus of Reinhold, augmenting the activities of Reinhold-Gould so as to render greater service to its customers and to utilize to the full the six-story warehouse at 261 Walton Avenue, which has tremendous storage facilities as well as a complete ruling plant.

G. E. Dyke Joins Robert Gair Co.

George E. Dyke, president of Robert Gair Company, Inc., New York, N. Y., announced today that Keith William Max has joined the staff of the company as a research advisory chemist. Dr. Max is a graduate of De Pauw University and an M. S. and Ph. D. of the Institute of Paper Chemistry, Appleton, Wis.

Triple-chain woven wire cloth, magnified about 32 times.

It is not easy to develop a product which will be used again and again—which is to be *standardized.* It is possibly even more taxing to have to evolve a *special* product—one which must be equally right, but will never be able to prove its case from a world of evidence. The triple-chain weave shown above is just such a specialty. It is comparatively delicate, fragile; calls for engineering with a very fine touch. Distinguished by extreme flexibility, a unique and smooth papermaking surface and good drainage characteristics, it has won a wide, lasting acceptance in the manufacture of certain grades of specialized tissues.

THE LINDSAY WIRE WEAVING COMPANY

Serving the Paper Industry Since 1903

14001-14299 ASPINWALL AVE. • CLEVELAND, OHIO

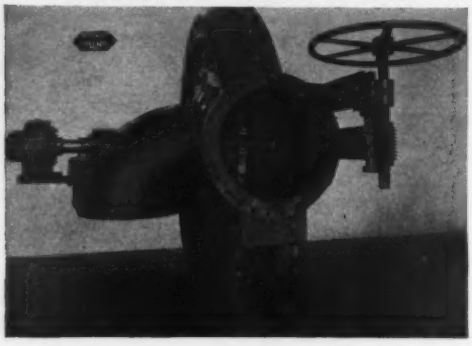
Lindsay **WIRES**

FOR PAPER MILLS

Increased Power Re-built Water Wheels

The illustration presented herewith is an example of how an "obsolete" water wheel can be modernized and re-built to give more power.

This is one of two 54-inch water wheels which were modernized recently for the Parker-Young Company in Lincoln, N. H., by the water wheel engineers of the Rodney Hunt Machine Company of Orange, Mass.



A Modernized Water Wheel

In this case, new runners were cast in one section. The old cast iron cases were rebored and equipped with new bronze gates and roller thrust and radial bearings.

The result was over a 20% increase in power, and the elimination of constant trouble and maintenance expense resulting from the fact that the old thrust bearings did not keep the runner in place.

The Rodney Hunt firm states that in many similar "remodeling" jobs in recent months their customers have been able to obtain power savings which will pay for the cost of modernization in a short time.

R. R. Zisette Made Gen. Sales Mgr.

The appointment of Robert R. Zisette, as general sales manager of SKF Industries, Inc., Philadelphia manufacturers of ball and roller bearings, has just been announced by Richard H. DeMott, vice-president in charge of sales.

The degree of Mechanical Engineer was conferred upon Mr. Zisette by Yale University in 1921. In September of that year he started with SKF. After one year in engineering and sales departments, he became sales engineer in the Cleveland office. He remained in this position for seven years, then was promoted to district manager of the Cincinnati office. On June 1, 1942 he was promoted again, this time to the office of assistant sales manager.

Howard Papers in Mexico

The Howard Paper Company of Urbana, Ohio, advises that it has recently appointed the National Paper and Type Company of New York as distributors of its various papers in the Republic of Mexico. This arrangement will make the well-known Howard qualities available to the entire printing trade in Mexico, since the National Paper and Type Company plans to carry stocks at its warehouses in Mexico City, Monterey, Mazatlan, Guadalajara, Veracruz, Torreon and Tampico. The National Paper and Type Company established its principal warehouse in Mexico City in May 1900, and since then it has been acting as Mexican distributors for many well-known American-made mill brand papers.

A

brief

sales message to

busy *chipper knife* buyers

Reading time: 30 seconds

The first step in the manufacture of Heppenstall's regular line of chipper knives is the production of special alloy steel in Heppenstall's own electric induction steel furnaces. The finest steel in the world is made in these furnaces which is one reason Heppenstall has always been able to guarantee its knives so strongly—that plus advanced methods of manufacture based upon more than 50 years of experience in the forging of fine steel products. When your knives need replacement, specify *Heppenstall Company*, Pittsburgh, Pa.

Bagley & Sewall Buy Rayonier Mill

It is reported that Rayonier, Inc., with headquarters at 343 Sansome street, San Francisco, sold its abandoned Tacoma, Wash. plant to the Bagley & Sewall Company of Watertown, N. Y. last April. This plant produced about 150 tons per day of unbleached sulphite pulp that was finally processed to Rayonier's mill at Shelton, Wash. The abandonment followed the shutdown of the Tacoma plant in November, 1942 because of allocation by the WPB under its order number M-251 covering logs used in pulp manufacture.

The Bagley & Sewall Company has a representative in Tacoma supervising the dismantling of the plant and disposal of the equipment.

Otto D. Tolischus to Speak

Otto D. Tolischus, well-known foreign correspondent and author, will discuss the war and the background of the war in Europe and Asia at the luncheon to be held in the Grand Ballroom of the Commodore Hotel in New York City on June 17.

Mr. Tolischus was in Tokio on December 7, 1941, when Pearl Harbor was attacked, and has written a graphic account on the political, diplomatic, economic and military developments in Japan during the fateful year 1941 in his recent book, "Tokio Record". Before going to Japan Mr. Tolischus was stationed at Berlin as foreign correspondent for the New York Times in 1933-40. Because of these experiences on both fronts Mr. Tolischus will speak with authority on "Our Enemies—on Both Fronts."

Mr. Tolischus was educated at the Columbia School of Journalism and after serving as reporter and city editor of the Cleveland Press went abroad as foreign correspondent and was awarded the Pulitzer Prize for the best foreign correspondent in 1939 and the Columbia University Medal for Excellence in 1941. Besides "Tokio Record" Mr. Tolischus is also author of "They Wanted War", which tells the dramatic story of Hitler's rise to power.

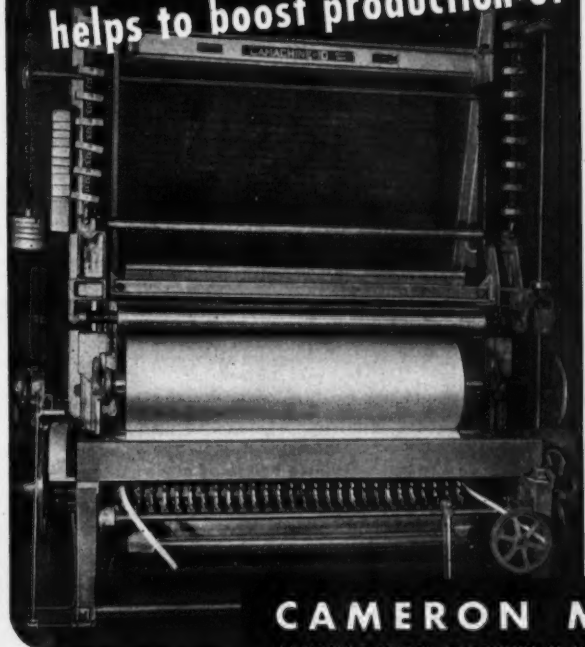
H. H. Belcher Joins Rodney Hunt

The Rodney Hunt Machine Company of Orange, Mass., announces that Harold H. Belcher has joined their organization to take charge of engineering and development work for the Textile Machinery Division.

Mr. Belcher received his engineering degree from Massachusetts Institute of Technology, Class of 1925. Continuously since that time he has been actively engaged in machinery design for the textile industry. For the past two years he has been designing engineer for Proctor & Schwartz, Inc. of Philadelphia, Pa. Previous to that he was chief engineer and secretary of Philadelphia Drying Machinery Company until this company was combined with Proctor & Schwartz, Inc.

Mr. Belcher has designed many special machines used in the textile and other industries, and has many patents for new equipment and improvements to his credit. Rodney Hunt Machine Company feels that the addition of Mr. Belcher to its staff assures continuation of the high degree of engineering service that this century-old concern has always maintained.

CAMACHINE 10-14D
helps to boost production of
Spiral Tube Containers



Camachine 10-14D winds rolls up to 60" in diameter, slits strips as narrow as ½". Speeds up to 1500 f.p.m. on paper, or 1000 f.p.m. on board. Can be furnished with score cut or shear cut slitter units as specified.

Keep spiral tube winders operating at top speed with rolls wound on the Camachine 10-14D.

To meet staggering wartime requirements for powder, shell and ammunition containers, Spiral Tube Winding Machines must keep operating steadily at top speed. Camachine 10-14D helps to boost the production of spiral tube containers by supplying the tube-winding machines with ample quantities of firmly wound board rolls, slit to the proper widths. Camachine 10-14D runs at 1000 f.p.m. on board rolls up to 50" diameter, winding on 9 15/16" drums to avoid cracking the board. Write today for interesting facts and figures concerning production obtainable with this equipment.

CAMERON MACHINE COMPANY
61 POPLAR STREET, BROOKLYN, N. Y. · MIDWEST OFFICE: 111 WEST MONROE STREET, CHICAGO

WILL DISCUSS SAFETY TO CONSERVE MANPOWER

(Continued from page 7)

of the Wisconsin mills, but the flood levels, especially on the Wisconsin River, began to reecde before much damage was done.

The Marathon Paper Mills Company, Rothschild, Wis., was obliged to shut down its pulp mill temporarily because of curtailed hydro-electric power due to the high tailwaters below the company's power dam. The woodroom also was closed for a brief period.

Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., opened 10 of the 19 gates of its main dam to release the flood waters. The level at one time reached the flood stage of 12 feet, and the rate of flow was as high as 54,000 cubic feet per second. Basement quarters at the company's main office were evacuated as a precautionary move.

It was necessary to open all twenty gates of the dams at Neenah and Menasha, Wis., to give the Fox River unrestricted flow to keep down the level. One break in the wall occurred at the lower dam at Appleton, near the Interlake Pulp and Paper Company division of the Consolidated company, but temporary repairs were made with stone.

High wind tore off a section of the roof at the machine room of the John Strange Paper Company, Menasha, and carried it 130 feet to the roof of a warehouse. None of the machinery was damaged. The estimated cost of repairs is $3,000, according to Hugh M. Strange, secretary-treasurer.

Lightning struck the power sub-station of the Kimberly-Clark Corporation near the main offices at Neenah, Wis. This caused a power failure in the company's mills lasting half an hour.

Forest Laboratory To Receive $989,767

A senate appropriations subcommittee at Washington, D. C., voted June 3 to recommend an appropriation of $989,767 for the United States Forest Products Laboratory, Madison, Wis., for the next fiscal year. This amount is $140,280 above the amount allowed by the House, and would exceed the Bureau of the Budget's recommendation of $940,280. The institution is geared entirely to war service, and a larger appropriation was considered necessary.

Mill Workers Get Health Test

Approximately 4,500 employees of paper mills and other industries at Wausau, Rothschild and Brokaw, Wis., have been given free chest X-rays using the portable equipment of the state board of health. The work has been going on since April 22 and will be completed this week. An average of 200 persons per day were examined, and the technicians in charge estimate that one per cent were found to have active tuberculosis. The idea was well received by the employees.

Pulpwood Timber Put on Market

Several lots of pulpwood timber have been put on the market, according to a bulletin of the State Timber Marketing Committee. In the Chequamegon National Forest, the United States Forest Service offers 2,000 cords of aspen pulpwood located in Ashland County, and 700 cords of aspen and 80 cords of spruce in Sawyer County. Further information may be obtained by writing to: Forest Supervisor, U.S. Forest Service, Park Falls, Wis.

Washburn County will offer for competitive bids in the near future: 50 acres containing approximately 39,000 board feet of white and Norway pine, white spruce, sawlogs or ties, marked for cutting; 60 acres with approximately 300 cords of aspen boxbolts, pulpwood or excelsior bolts (all trees 6" or over in diameter at breast height to be cut); 40 acres, approximately 25,000 board feet of Jack pine sawlogs or tie cuts (all trees 9" or over in diameter at breast height to be cut, and some 7" to 9" to be marked for cutting. Inquiries may be addressed to: District Forester, Conservation Department, Spooner, Wis. The timber is owned by Washburn County. Bid forms and terms of timber sales will be furnished on request.

John G. Strange Reelected

John G. Strange, secretary of the Institute of Paper Chemistry, was reelected an alumni trustee of Lawrence College, Appleton, Wis. He was named by the board of trustees of the college at its annual meeting.

Power Situation in Canada Favorable

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., June 7, 1943—Electrical power producers were able to weather the peak power load of last winter without too much inconvenience and the worst appears to be over as far as electrical power is concerned for the prosecution of the war. The switching of power from one place to another along with the re-allocation of energy among the pulp and paper plants and other conservation measures enabled the power producers to meet all requirements. Large blocks of electrical energy have since been added to the already enormous supply through the completion of some of the units of the great Shipshaw development in Quebec and by July another 65,000 hp. will be available in Ontario from the Ontario Hydro Power Commission's new $6,000,000 development at Decew Falls in the Niagara peninsula. The Hydro Commission also expects to have completed by November or December another new power line from a point near Port Arthur to the Steep Rock iron mine in Northern Ontario.

The Commission has also done much preliminary work in connection with a $40,000,000 development at Des Joachims on the Ottawa River. Construction work on this project will depend on how priorities for materials can be worked out. Most of the necessary legislation in the two provinces of Ontario and Quebec has been passed and the Federal government has drafted a bill to complete its share of the three-way agreement, but this bill has not yet been introduced. Water conditions appear to be favorable unless an unprecedented drought sets in to compensate for the present long-continued wet spell. Major war industry expansion has now been completed and there seems to be no reason to fear any great inconvenience to the pulp and paper industry in the immediate future, as far as electrical energy is concerned.

FINANCIAL NEWS

New York Stock Exchange

High, Low and Last for Week Ending June 5, 1943

STOCKS

	High	Low	Last
A. P. W.	2¾	2½	2⅝
Armstrong Cork Co.	40¾	38	40¾
Celotex Corp.	14½	14⅛	14⅜
Celotex Corp., pf.	91¾	90	90
Certain-Teed Products Corp.	7⅜	6¾	7⅛
Certain-Teed Products Corp., pf.	61	57½	60¾
Champion Paper & Fibre Co.	21¾	21	21¾
Champion Paper & Fibre Co., pf.	107	107	107
Congoleum Nairn Co.	25	23⅞	25
Container Corp. of America	23¼	23	23
Continental-Diamond Fibre Co.	14⅞	14⅛	14⅞
Crown-Zellerbach Co.	16	14⅞	15½
Crown-Zellerbach Co., pf.	94	93½	93½
Dixie Cup Co.	14½	14⅛	14½
Dixie Cup Co., —A.	42½	42⅜	42½
Flintkote Co.	22⅜	21	22
Flintkote Co., pf.	102	102	102
Robert Gair	3⅞	3⅛	3⅞
Robert Gair, pf.	13¾	13¾	13¾
International Paper Co.	13½	11⅞	13¼
International Paper Co., pf.	59¾	57½	59½
Johns-Manville Corp.	89¾	88	88
Johns-Manville Corp., pf.	130	129¾	130
Kimberly-Clark Corp.	31	31	31
MacAndrews & Forbes	26	25¾	25¾
MacAndrews & Forbes, pf.	....	....	....
Masonite Corp.	42	41¼	41½
Mead Corp.	10	9¾	10
Mead Corp., pf. A—6%	80	80	80
Mead Corp., pf. B—5½%	71	70	71
Paraffine Companies, Inc.	44⅞	43¾	44¾
Paraffine Companies, Inc., pf.	105	105	105
Rayonier, Inc.	14⅜	13⅜	14⅜
Rayonier, Inc., pf.	29½	29⅛	29½
Ruberoid Co.	26¾	24⅜	26¾
Scott Paper Co.	42⅜	42¼	42¼
Scott Paper Co., pf.	111⅜	111⅜	111⅜
Sutherland Paper Co.	31	31	31
Union Bag & Paper Corp.	11⅜	11¼	11⅜
United Paperboard Co.	5¼	5⅛	5¼
U. S. Gypsum Co.	72½	70	72½
U. S. Gypsum Co., pf.	180	180	180
West Virginia Pulp & Paper Co.	15⅞	15⅜	15⅞
West Virginia Pulp & Paper Co., pf.	107⅞	107⅞	107⅞

BONDS

Abitibi Pulp & Paper Co. 5s '53	72	70½	72
Celotex Corp. 4½s '47	101½	101¼	101½
Certain-Teed Products Corp. 5½s '48	100	99⅜	100
Champion Paper & Fibre Co. 4¼s '50	....	....	....
International Paper Co. 6s '55	106¾	106	106¾
International Paper Co. 5s '47	104½	104	104½
Mead Corp. 3¼s '53	....	....	....
West Virginia Pulp & Paper Co. 3s '54	103⅜	103⅜	103⅜

New York Curb Exchange

High, Low and Last for Week Ending June 5, 1943

STOCKS

	High	Low	Last
American Box Board Co.	7¼	7¼	7¼
Brown Co., pf.	....	....	....
Great Northern Paper Co.	35	33	35
Hummel-Ross Fibre Corp.	4⅞	4¼	4¼
National Container Corp.	12¼	12⅛	12¼
St. Regis Paper Co.	3⅞	3¾	3⅞
St. Regis Paper Co., pf.	136	135	136
Taggart Corp.	5¼	4⅞	5¼

BONDS

American Writing Paper Co. 6s '61	93¼	92½	93¼

Paper Securities Up in Canada

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., June 7, 1943—Another of the periodic flurries in the securities of the paper stocks is now under way on the Montreal Stock Exchange. Such has been the vigor of the present upswing that the group's average has been lifted 15 points since May 27, and on a recent day 33,000 of the 80,000 shares dealt in on the exchange were "papers." This rise is attributed to various factors, immediate and prospective. The chief reason is thought to be the easing of the situation in the matter of power, due to the ample supplies of water in the rivers feeding hydro-electric developments. Then there is the prospect, still held to be favorable, for Washington action permitting an upward price adjustment this year for newsprint. Ottawa is favorable to such an adjustment, and it is understood Washington officials also have been convinced of the strength of the Canadian manufacturers' case, the only fly in the ointment being political difficulties due to the problem of many smaller publishers to keep solvent with paper consumption and advertising reduced.

A long-range prospect thought also to have a bearing on the strength of the paper stocks is in respect to the plastics field. A number of companies have been experimenting with the production of new plastics from wood. The Howard Smith Paper Mills, for instance, have done considerable research work along this line, and during the past week discussion has developed in newsprint manufacturing circles over statement of Garfield Weston that he foresaw a big future for the forest products industry. Weston, considered a shrewd business man, has purchased the majority and minority interests in E. B. Eddy Co., and in recent interview indicated that he anticipated important possibilities for paper companies, including output of new plastic products.

Bathurst Profits Drop

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., June 7, 1943—The profits of Bathurst Power and Paper Company Limited were sharply lower in the first quarter of 1943, the total of $117,739 (after depreciation and depletion but before income and excess profits taxes), being little better than one-fourth of the $425,090 reported for the first quarter last year. This result is in line with the statement by President Weldon at the annual meeting in March that there was a substantial drop in earnings during the first two months, in connection with which he said: "Under the conditions which prevail it would appear certain that no abatement of the trend of rising costs can be expected, and if no relief is obtained in the matter of selling prices earnings must be considered as being established on a definitely lower basis." The directors declared a dividend of 25c only for the quarter, as compared with 25c regular plus a 25c extra declared for the same period last year.

A.P.W. Paper Co. Nets $50,000

The A. P. W. Paper Company, Inc., reports for July 1, 1942, to April 30, 1943: Net profit after $50,000 provision for contingencies was $26,407, compared with $199,549 for comparable period a year earlier when $25,625 was provided for inventory reserves and $56,637 was reserved for contingencies.

St. Regis Votes Dividend

The St. Regis Paper Company has voted a dividend of $1.75 a share on the preferred, payable July 1 to stock of record June 12, leaving arreas of $70 a share.

This will bring payments this year to $5.25 a share, against $3.50 paid in the year 1942.

Rules on Wood Pulp Imports

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, June 9, 1943—Wood pulp may not be imported from Canada after the effective date of the Maximum Price Regulation, at higher than maximum prices, even though title to the woodpulp passed to the purchaser in Canada prior to that date, the OPA has ruled.

"The regulation provides that on or after April 20, 1942, the effective date of the regulation, no person in the course of trade or business shall buy or receive woodpulp in the continental limits of the United States at more than the maximum prices set forth in the regulation," the agency explained, "hence woodpulp may not be imported from Canada after April 20, 1942, at prices in excess of the maximum prices, even though title has passed to the purchaser prior to that date."

Garrett-Buchanan Co. Expand

PHILADELPHIA, Pa., June 7, 1943—The Garrett-Buchanan Company announces the acquisition of an industrial paper department to its Baltimore division, consisting of towels, toilet tissues, drinking cups, etc., in which line it has established a number of new selling connections. Heretofore, the branch featured only printing and fine papers. Among the latest developments in connection with this branch, located at 7-9 East Lombard street, is the purchase of the Egerton Building, a five-story and basement structure at 26-30 East Pratt street containing about 34,000 square feet of space . This structure will be used as an addition to the Lombard street quarters, which the company also owns. Together with the other facilities, the new building also has a 2-car railroad siding and extensive parking space for trucks.

George J. Rittinger, formerly with the company's headquarters in Philadelphia, recently was appointed manager of the Baltimore division and has already assumed his new duties. G. Raymond Smith, who previously was manager of the Baltimore division, is now manager of the company's division in Reading, Pa. Charles Hansel, well known to the trade in Baltimore, has been added to the sales force, and with "Eddie" McQuaid and "Winnie" Roe the company is to be complimented on its ace sales force.

Camden I. P. Mill Gets Minute Man Flag

CULLENDALE, Ark., June 7, 1943—Employees here of the Camden mill of the Southern Kraft Division of the International Paper Company have received the Treasury's "T" Flag for buying war bonds, it was announced by officials of the Mill today. The Treasury's flag, a white Minute Man on a blue background with stars around it, has been received and is now being flown from the Mill's flag pole.

To receive this flag, 90 percent of the employes must use the voluntary withholding payroll deduction plan, and this deduction must also be 10 percent of the gross payroll. The Paper Mill has been on the voluntary payroll deduction plan for some time and was among the first industries in this section to adopt this policy of buying war bonds.

The mill has been eligible for the flag for some time, but the flag has just been received.

You can get necessary

SCREEN PLATES

provided your operation is essential to War effort or Civilian needs. No Screen Plate orders have yet been deliberately refused by W. P. B.

Send in your necessary orders at once, noting your best Priority Rating and your End Use allocation symbol. If you have any doubts or questions as to procedure, write us and we will supply full information and instructions by return mail.

Fitchburg Screen Plate Co., Inc.
301 SOUTH STREET
Fitchburg, Massachusetts

Pennsalt Changes

William P. Drake, recently appointed manager of sales of the Pennsylvania Salt Manufacturing Company, has been placed in charge of the company's sales of acid and alkali-resistant cements and chlorinated organic chemicals, in addition to his former duties as Manager of the Pennsalt Cleaner Division.

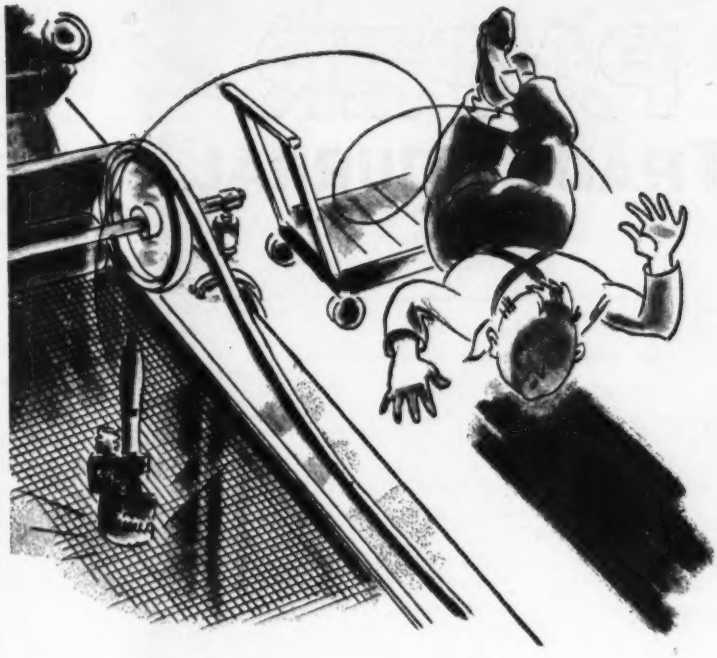
Mr. Drake started on April 7, 1934 at the Wyandotte Plant in the company student training course. After spending several years in the various plants and in the executive offices of the company, Mr. Drake took over the sale of the then new product, Orthosil, a development of the company's research department, which has found widespread usage in the industrial cleaning field. At that time Mr. Drake made his headquarters in Detroit. In May of 1939 he was appointed manager of the Pennsalt Cleaner Division, under which were combined Orthosil and other specialized industrial cleaners.

In taking over his new responsibilities, Mr. Drake has made recent changes in his Department in order to better serve the war industries which consume nearly 100% of the products under his supervision.

Albert H. Clem and Joseph J. Duffy, formerly in the Detroit and Rochester territories respectively, were brought to Philadelphia to assist Mr. Drake in the Pennsalt Cleaner Division. Both are chemical engineers, Mr. Clem being responsible for technical service to arms plants, while Mr. Duffy is responsible for technical service to the airplane industry. J. S. Dimon, formerly the company's local representative in the Philadelphia area, has been given charge of sales and service in the transportation field, while W. J. Hennessy, with headquarters in Pittsburgh, is in charge of technical service to the steel industry.

In addition to Messrs. Clem and Duffy, Mr. Drake has assisting him in Philadelphia Vincent A. Curll, also a chemical engineer who has had considerable experience with acid and alkali-resistant cements.

Recent additions to Mr. Drake's department are Edward J. McDevitt, who is now located in St. Louis, and John C. Hampson, formerly in the Company's General Laboratories Division, who has been transferred to the Pennsalt Cleaner Division with headquarters in Indianapolis. W. J. Stoddard, who formerly covered the Indianapolis territory, is now in the Detroit territory.



Johnny-come-lately marched down through,
twirling a wrench near Number Two,
Tripped on a truck somebody left there,
and the wrench went sailing . . . well, you know where.
It blasted the couch, tore up the rolls,
and left the new wire plumb full of holes.
Production, too, now has taken a fall . . .
truck, wrench, and Johnny were the cause of it all.

When Johnny-come-lately is trained to treat them with care, your Cheney Bigelow Wires deliver all the fine service you've come to expect. You can count on continued high quality in Cheney Bigelow Wires because we're keeping our skilled wire craftsmen on the job. Much of our production is now devoted to vital military items, *but we're also going right on with development and manufacture of Fourdrinier wires and other mill equipment* . . . with full government approval, for paper, too, is a weapon.

CHENEY BIGELOW

Fourdrinier Wires • • *Dandys* • • *Cylinders* • • *Wire Cloth*

CHENEY BIGELOW WIRE WORKS · 417 LIBERTY STREET · SPRINGFIELD, MASS.

PAPER
TRADE JOURNAL
Title Reg. U. S. Pat. Off.
Henry J. Berger
EDITOR

Vol. 116 June 10, 1943 No. 23

COMING EVENTS IN PAPER INDUSTRY

New England Section. Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Roger Smith Hotel, Holyoke, Mass.

Delaware Valley Section. Technical Association of the Pulp and Paper Industry—First Friday of each month at the Engineers Club, Philadelphia, Pa.

Lake States Section. Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

Kalamazoo Valley Section. Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park, American Hotel, Kalamazoo, Mich.

American Pulp and Paper Mill Superintendents Association, Twenty-fourth Annual Convention, Commodore Hotel, New York, June 15-17.

PUBLIC DEBT

The high and increasing public debt is a rather complex controversial subject. There are two recognized viewpoints to be considered. In discussing "The New Philosophy of Public Debt", under that title, Harold G. Moulton, has written a book which clearly presents the views of those who approve and disapprove of a high public debt and an unbalanced budget. This study is an important and informative contribution to debt and taxes and it has just been published by The Brookings Institution, Washington, D. C., an organization devoted to public service in the social sciences. It explains that the two opposing philosophies with respect to public finance embrace the traditional view, which considers a continuously rising public debt imperils the financial stability of the nation. The second or new conception, is that a huge public debt is a national asset and that continuous deficit spending is essential to the economic prosperity of the nation.

The traditional view, Mr. Moulton explains, "is held by the Treasury, by the Federal Reserve System, by the President, by many leaders in the House and Senate, and by many individuals in the Administration. The new conception is advocated by the National Resources Planning Board, by numerous prominent persons in the government, and by groups not connected with the Administration. The traditional point of view was stated explicitly by Secretary Morgenthau in testifying before the Senate Finance Committee on August 8, 1941, as follows: 'The defense program is an absolute necessity. It must be paid for. In so far as possible, it should be paid for now. Borrowing should be kept to a minimum to maintain our fiscal strength. The rise in the Federal debt means merely that the taxpayer's burden is being postponed—that both principal and interest must be paid later out of higher taxes collected at a time when they may be harder to pay and less willingly paid than now. . . . An all-out tax program will build public morale in an all-out defense program. By reducing the necessity for borrowing, it will strengthen confidence in the impregnable fiscal position of the Government." The author quotes from the statement of the Federal Advisory Council in a special report of the Board of Governors of the Federal Reserve System to Congress on December 30, 1940, as follows: "Whatever the point may be at which the budget should be balanced, there cannot be any question that whenever the country approaches a condition of full utilization of its economic capacity, with appropriate consideration of both employment and production, the budget should be balanced. This will be essential if monetary responsibility is to be discharged effectively."

In reference to the new conception of public debt, the author states that "The new philosophy holds that public finance is really only a matter of bookkeeping, that a rising debt has no adverse consequences, and that without a constantly increasing debt we cannot hope to have full employment and prosperity. The National Resources Planning Board, official agency of the Administration with respect to the broad field of economic and social planning, in its pamphlet entitled 'After Defense—What?' holds that financial costs are of no consequence—that if we just go ahead boldly with production everything will be in order: 'When we organize for maximum production on the basis of full employment, without being stopped by the costs, we discover, as have other nations, that increased production pays the real costs involved. Doing the job pays the bill. In other words, the central problem is not money, it is manpower, resources, and organization. At last, we are beginning to see that finance was made for man, and not man for finance'."

In discussing modern methods of control the study states in part: "The moral of all this is that if we are willing to apply totalitarian methods of control, inflation might be largely held in check, even with a constant increase of the public debt. We should have to control wage rates and farm incomes; we should have to regulate corporate earnings; we should have to control investment; we should have to ration commodities; we should have to control rents; we should have to license foreign trade; we should have to supervise and possibly close, the security and commodity markets. Given regimentation of virtually every phase of economic life, the process of inflation might be held in leash. The principal advocates of the new philosophy of public debt have, however, expressed themselves as opposed to regimentation, as strongly in favor of the system of free enterprise:

'We do not want the Government to run the whole show. We do not want a totalitarian state. We want freedom of enterprise . . . we shall have in our hands the tools by which we can create a greater measure of economic justice, without sacrificing any of the essential freedoms'."

In concluding the chapter on debt and inflation the study states that "It will be necessary to make a choice. With unlimited debt expansion we cannot prevent inflation without the use of totalitarian methods of control. No compromise or half-way measures can adjust the difficulties. The choice is between regimentation and inflation. The foregoing analysis serves to disclose the gravest danger with which the United States is now confronted. Unable or unwilling to perceive basic inconsistencies, or to choose between clear-cut alternatives, we drift toward the deep financial waters from which there is no return other than through repudiation in one form or another."

Lee Paper Co. Incorporates

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., June 7, 1943—The Lee Paper Company, 101 Business street, Hyde Park, dealing in paper products, box boards, etc., has been incorporated under the name of Lee Paper Company, Inc., with a capital stock of $10,000; 100 common shares of $100 each. Leo Arthur Fandrey, 25 Alden Road, Dedham, Mass., is president and treasurer; Grace Rita Fandrey, clerk, and David W. Sheehan is the third incorporator.

Production Ratio Report*

(Production as per cent of six-day capacity)

COMPARATIVE WEEKLY SUMMARIES

Current Weeks—1943		Corresponding Weeks—1942	
April 24	89.8	April 25	100.1
May 1	85.7	May 2	99.8
May 8	91.7	May 9	98.2
May 15	91.4	May 16	97.8
May 22	92.7	May 23	93.9
May 29	92.7	May 30	91.4

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1942	104.5	103.9	102.9	100.4	95.3	87.4	75.8
1943	87.2	88.9	89.5	88.8	91.9	....	....

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1942	80.8	82.8	90.6	86.9	80.1	90.4
1943	....	....	....	....	....	....

COMPARATIVE YEARLY SUMMARIES

	1936	1937	1938	1939	1940	1941	1942	1943
Year to Date	78.0	89.6	67.8	80.1	86.3	92.4	101.3	89.2
Year Average	80.4	79.8	71.5	83.4	85.6	97.4	90.4	....

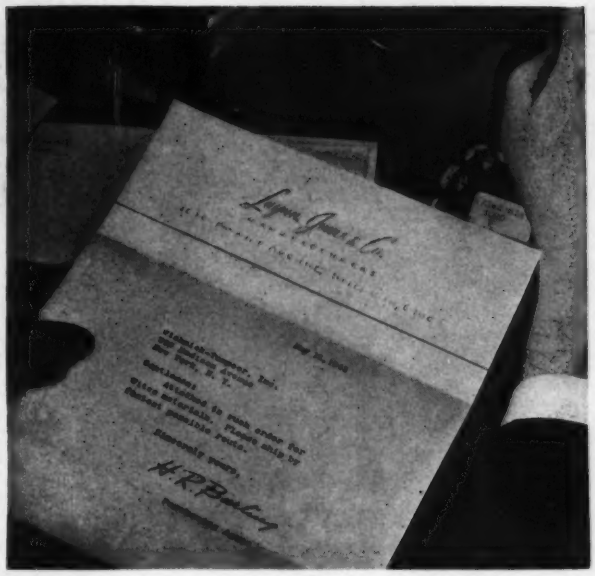
* Based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

PAPERBOARD OPERATING RATIOS†

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Avg.
1937	83	89	89	91	88	80	69	77	72	70	57	47	75
1938	56	63	63	60	60	59	59	60	70	73	67	61	64
1939	65	73	76	74	69	73	68	77	82	91	88	77	77
1940	78	75	74	76	82	85	77	79	78	85	82	77	78
1941	81	88	89	89	91	94	92	98	95	99	98	90	92
1942	102	101	101	95	82	72	68	75	76	81	82	77	84
1943	86	88	94	94	96	..	..	..	..	..	..	..	..

Week ending April 24, 1943—97
Week ending May 1, 1943—89
Week ending May 8, 1943—96
Week ending May 15, 1943—96
Week ending May 22, 1943—96
Week ending May 29, 1943—95

† Per cents of operation based on "Inch-Hours" reported to the National Paperboard Assn.



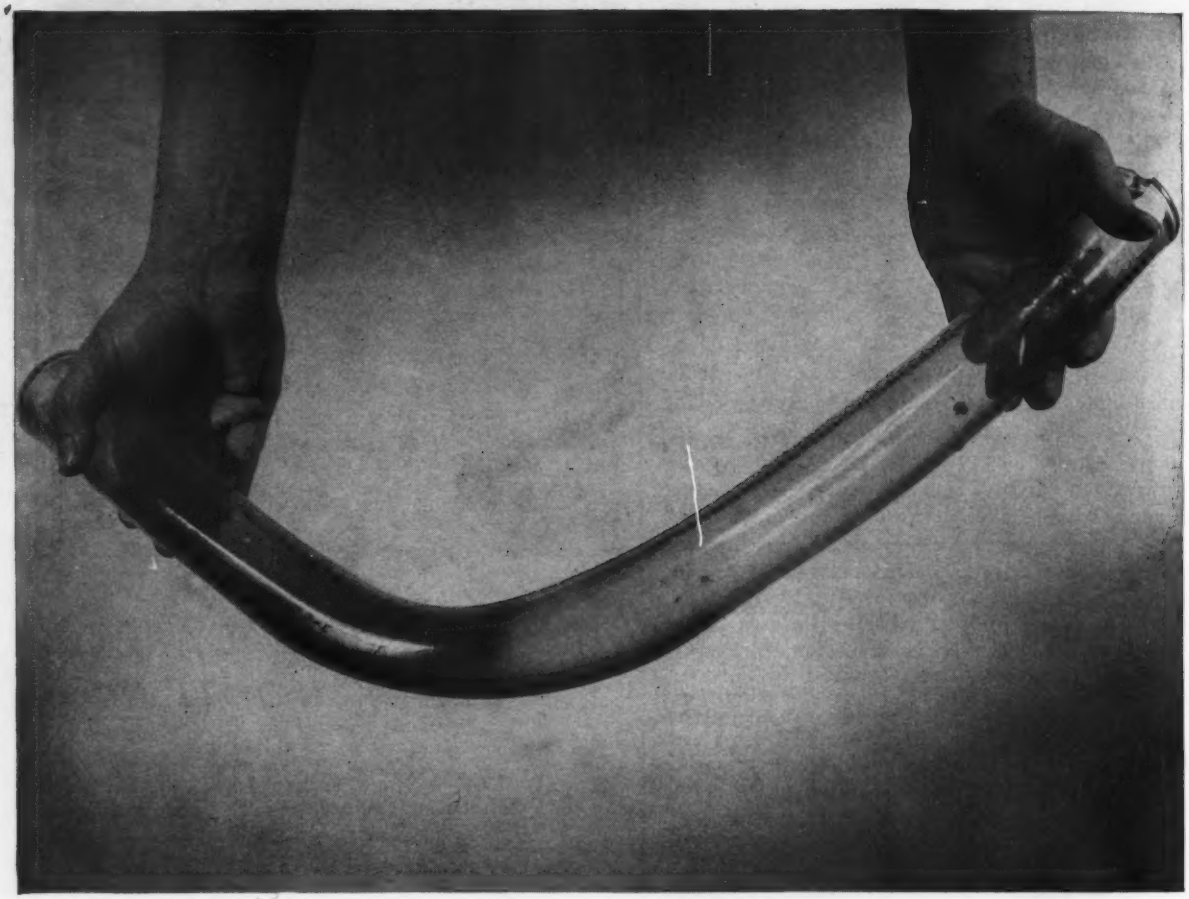
ORDER WITCO CARBON BLACK NO. 11 NOW

Here is an opportunity to save time and money in the production of your black paper and paper board. Use WITCO BLACK NO. 11, a special black, developed expressly for paper production. It is of the dustless type, cleaner than the uncompressed black usually employed in the industry . . . and can be incorporated directly into the beater. Order WITCO BLACK NO. 11 now and make substantial savings while improving the quality of your products.

WISHNICK-TUMPEER, INC.

Manufacturers and Exporters

New York, 295 Madison Avenue • Boston, 141 Milk Street • Chicago, Tribune Tower • Cleveland, 616 St. Clair Avenue, N.E. • Witco Affiliates: The Pioneer Asphalt Company • Panhandle Carbon Company • Foreign Office, London, England.



PYREX PIPING *IS TOUGH!*

Part of a well-known wine cellar was razed by fire recently. Almost everything in the burned buildings was destroyed beyond salvage or recognition. But shown above is a section of PYREX brand glass piping picked out of the ruins. It was bent by the heat. One end was chipped when it crashed. It is of no earthly use today, yet it is still clearly a piece of Pyrex piping! By contrast, the tiny flecks visible on its surface are splashes of molten aluminum.

Engineers everywhere know that PYREX piping is chemically stable and highly resistant to thermal shock. They know that it is easy to clean and that its transparency facilitates and even assures the success of many operations. The one objection to its use—and it is raised *only* by those who have had no experience with it—is that glass is fragile. Engineers, however, with large installations of PYREX piping say that even under rough and ready conditions breakage is not a serious problem.

The above survivor of a devastating fire shows that PYREX piping can "take it"—that PYREX brand Industrial Glass has strength and stability far in excess of the demands of most industrial services. If you could benefit by the characteristics obtainable only in PYREX piping, write to the Industrial Division, Corning Glass Works, Corning, N. Y. And remember, PYREX Piping is available *today*.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.

CORNING
Glass Works
Corning, New York

Pyrex Industrial Glass

Section of the
TECHNICAL ASSOCIATION
OF THE PULP & PAPER INDUSTRY

Edited by R. G. Macdonald, Secretary

Application of the Lithographic Processes to War Work*

By William H. Wood[1]

Abstract

The war emergency makes it possible for lithographers to contribute directly in furthering the war effort by the adaptation of lithographic processes in the manufacture of templates, dials, gage sticks, aeroplane loft panels, and similar items.

Cameras and platemaking equipment must be of the highest quality and in first class order.

The deep-etch process is most adaptable for this class of war work.

Straight chemical methods may be used for certain types of dials, templates and panels or the electrolytic etching process may be adapted to the more resistant base metals for the above varieties of work.

Among the many miscellaneous applications of the lithographic process in war work are found the making of metallic work sheets and instruction sheets as well as the printing of ultraviolet fluorescent background field maps, and aerial navigation maps.

The present war emergency makes it possible for lithographers to contribute directly in furthering the "war effort." Beside the usual printing of government forms, Army maps, and the like, lithographic plants when properly equipped may proceed with the making of templates, loft drawings, dials, gage sticks, panels, for tank, aircraft and ordnance production.

Templates, Loft Drawings

Many of the lithographic processes familiar to all lithographers can be adapted readily to this purpose. When it is realized that the production of one new aeroplane requires the making of many thousands of templates before the first plane can be made and that these must be changed as often as a design is changed, it can readily be seen that the market for these is tremendous. If the lithographic shop owner contemplates the production of templates, loft drawings, and the like, he should first investigate his facilities rather thoroughly because template making requires precision of a fairly high order of accuracy.

Cameras and platemaking equipment must be in first-class shape and lenses on process cameras should be checked for flatness of field and constancy of image size. The premises must be kept clean and dust free. Templates may be delivered to a company in finished form or they may be delivered unfinished if the company has its own template cutting department.

Although the securing of business is outside the province of this paper, shop owners should contact such firms as the aircraft companies, automobile companies, heavy machinery manufacturers, and others in similar work. In many cases these contractors or subcontractors have no facilities of their own for producing templates and they are willing to arrange contracts with lithographers for the production of these in the lithographic plant.

Templates bring a price which is sufficiently high to make the usual lithographic plate seem cheap by comparison. If the lithographic plant has sufficiently large and precise metal cameras it can easily produce loft panels for the aeroplane manufacturer. The process of preparing the loft involves copying with a high degree of precision, drawings prepared by the aviation draftsman. High-contrast plates are required for this, because the drawings are usually in pencil and often times have been severely handled before the lithographer gets them. After copying the drawings on a high-contrast plate, the drawings are projected upon large sheets of steel using a silver halide emulsion on the sheet; if high-intensity mercury arcs or high-intensity carbon arc lamps are used for projection, dichromated coatings such as deep-etch coatings may be used. Either method is satisfactory but the deep-etch method gives a loft plate of greater permanence. This process involves nothing new to the lithographer beyond the coating of large size plates up to ten or twelve feet in length.

By projection it is possible to eliminate the need for large films having nonstretch characteristics. Many of the aircraft companies have facilities for production of lofts but many of their subcontractors do not.

Template production is essentially similar to loft production except that we operate with smaller originals and reproduce the design in smaller dimensions. The production of templates, accordingly, is not so difficult for the lithographer to master. Templates are used as guides for checking metal sheet parts, sections of ordnance pieces, and other similar designs.

Deep-Etch and Surface-Plate Processes

The lithographer may produce template drawings by either the "surface-plate process" or the "deep-etch process." Here again the deep-etch process results in a plate of greater permanence than the sur-

* Presented at the Annual Meeting of the Technical Association of the Pulp & Paper Industry, Hotel Commodore, New York, N. Y., Feb. 15-18, 1943.

[1] Director of Research, Harris Seybold Potter Co., Cleveland, Ohio.

face-plate process. As a base metal for the template, zinc or galvanized steel or auto-body steel may be employed interchangeably. The surface of the sheets may be grained in the usual way as is customary in the lithographic process. A rather fine grain is best. The dichromated colloid coating, which may be albumen or one of the synthetics, is flowed over the plate in a whirler or by sponging. It is then dried and exposed under a master negative which may be a direct one to one copy of the template drawing or template original. It is best to use a high-contrast silver halide emulsion on a glass plate as a negative material. Exposure of the dried coating in a printing frame is carried out as in the regular lithograph process. A colored developing ink is used and the print is developed under water, as is customary in making a lithographic plate. The plate is then gummed up and delivered to the cutting room for cutting to exact size. If extra protection is required as would be the case with templates which required a great deal of handling in the plant, we would eliminate the gumming up process and instead apply a coating of an abrasion proof transparent lacquer which would be spread over the entire design and allowed to dry before the template was cut out. Methylmethacrylate resin lacquer is suitable for this purpose.

If we wish to make the plates by the deep-etch process, the procedure to be followed is much the same except that deep etch materials are used throughout and a positive instead of a negative is used as a master stencil. Deep-etch templates are considerably better than templates produced by the surface-plate process, because all of the template detail is below the surface and hence is not easily damaged through handling. Zinc and galvanized sheet steel is the best material for preparing deep-etch templates. Auto-body steel is too difficult to etch by the usual chemical etches. Sheet steel can be etched by using the deep-etch method coupled with an electrolysis process. In this method we can start with either a negative or positive master stencil.

If we start with a negative, we make a deep-etch plate in the usual way and obtain lines of hardened coating on the surface of the plate. The plate is thoroughly cleaned with alcohol to remove the deep-etch etching solution, after which the plate is dried and rolled up with a heavy resinous roll-up ink. The plate is then powdered with *dragons blood* or a similar powdered resin and is lightly fused on a hot plate. The entire plate is then placed in a tank of acidulated water which removes the semihardened colloid coating taking the overlying ink with it. When this operation is completed, the print is dried with absorbent tissues or chamois skin and powdered again with dragons blood which is then fused in by heating on a hot plate. This operation is repeated until a heavy resinous resist is built up leaving clear lines on the template surface. The whole plate is then immersed in an electrolytic bath which usually consists of a strong sodium chloride or ordinary salt solution to which acids or acid salts have been added. Soluble phosphates, such as sodium phosphate or ammonium phosphate, may be added to the bath and these phosphates will combine with the iron salts formed during the electrolytic-etching process to keep the bath clean and free of iron sediment. A relatively low-potential current is required for the electrolytic etching operation; from five to eight volts direct current is all that is required. Copper oxide or selenium disk rectifiers are efficient current sources. Current density averages about 6 to 10 amperes per square foot of conducting plate surface. The electrolytic-etching process requires that the template be the positive plate; a lead, or stainless steel, or carbon sheet may form the cathode or negative plate. Etching proceeds rapidly but it is not possible to cut all the way through a sheet of twenty gage auto-body steel without accessory powdering of the etched lines, because there is some line spread just as there is in chemical etching.

A serrated cathode will result in some improvement in the sharpness of lines; but it is still necessary to powder the lines, if we intend to cut all the way through the plate. It is perhaps simpler to cut part of the way through the plate and then the template may be snapped out easily in a vise. Any lines or graduations or reading matter appearing on the template may be blocked out after the first ten minutes of etching by means of a heavy resinous solution such as heavy asphaltum. This is for the purpose of protecting such detail and preventing overetching which might be harmful.

Electrolytic etching may also be carried out by starting with a positive and preparing the plate in the same manner as an ordinary lithographic deep-etch plate—i. e., a regular image covered with developing ink is applied to the plate surface. The light-sensitive semihardened colloid is then removed, and the plate is placed in an electrolytic-plating bath which may contain lead salts, such as lead sulphamate. A plated coating is thereby built up on the plate. When this is of sufficient thickness the lacquer and ink are removed with a powerful solvent, and the template is placed in the salt etching bath just as before. Perhaps this method is the simpler and more practical of the two methods.

A variation of this method may be to use a negative, as in the ink and dragons blood procedure, except that eletctroplating of the exposed bare metal is carried out instead of etching in the salt bath. A raised surface results and the walled inclosure thus formed can be filled with a protective resin layer such as coumarone-indene polymer. A light sanding with fine emery cloth will remove the resin from the high electroplated metal, and the lead deposit can then be dissolved away by making the plate the anode in a dilute sulphamic acid bath, after which it may be etched out in the sodium chloride-phosphate electrolytic etching solution.

The production of dials, gage sticks, and instrument panels by the lithographic process is closely related to template production and some of the methods are identical with those used in preparing templates. The deep-etch process is preferred for dial, gage stick, and panel production; generally zinc or aluminum sheets are employed but here again we may use galvanized steel if we wish. For preparing dials and panels having white letters or figures on a black background, we make a deep-etch plate in the usual way with a white ink in place of black ink and baking the plate after removing the semihardened deep-etch resist. The zinc surface may be blackened by using a solution of antimony chloride in anhydrous alcohol, or a solution of copper nitrate and potassium chlorate in water. The dial is then stamped or cut out as usual. If we wish permanence greater than the ink surface provides, we may use a white lacquer in place of the usual deep-etch lacquer.

If we require black letters on a white background,

then we prepare a high-etch deep-etch image, spraying white lacquer over the entire plate and removing it from the high-etched portions by using a flat abrasive sheet or by sponging away on absorbent tissues while the lacquer is still wet; the exposed zinc surface is then blackened with the alcoholic antimony chloride solution, or the copper nitrate-potassium chlorate solution, just as before. In some cases we may require that the zinc surface be left exposed in metallic form. Dial production requires on the average a lesser degree of precision than template production and it is not beyond the ability of any lithographer. Radium dials require a special production line.

There are many more miscellaneous applications of the lithographic process in war work and among these may be mentioned the making of permanent etched instruction sheets on metal plates for the benefit of shop employees, where such instructions are handled a great deal making paper-base instructions impractical. Any of the above processes may be employed for making such instruction sheets, but again we prefer the deep-etch method or the electrolytic-etching method. A suitable metal base for such instruction sheets is provided by the use of thin-gage galvanized steel. This makes a practically indestructable base for the image which should be lacquered for greater permanence.

The printing of ultraviolet fluorescent backgrounds for field maps, aerial navigation maps and the like involves no new techniques for the skilled lithographer. A high-etch plate made by the reverse deep-etch method will make it possible to print in the fluorescent background with a water solution or a water-base ink incorporating a fluorescent dyestuff such as a selected member of the sulphoflavine series. (Sulphoflavine F.—General Dyestuff Co.) Any desired map detail is then printed in by lithography using regular lithographic inks.

TAPPI Standard Withdrawn

On recommendation of the Paper Testing Committee of the Technical Association of the Pulp and Paper Industry, the TAPPI Standards Committee has withdrawn Suggested Method T 443 sm-39, Water Permeability of Paper and Paperboard (Ground-Glass Method). It has been found, as a result of investigations carried out at the National Bureau of Standards, that the method gives unreliable results with certain present types of water resistant papers. The Paper Testing Committee has under way an intensive study of the subject of testing for moisture resistance and resistance to water vapor permeation.

Acme Steel Wins Safety Award

The Riverdale plant of Acme Steel Company, Chicago won the coveted first place plaque in their group of the Steel Rolling and Fabricating Division competition sponsored by the Greater Chicago Safety Council. The presentation was made at the closing session of the annual convention held May 6 at the Hotel Sherman. C. E. Waddell, safety director of the company accepted the award before a group of some 1,500 safety leaders.

At the Riverdale plant of the company 2,350 people responsible for this fine safety record are employed in the rolling mills, machine shops, fabricating and steel strapping departments.

Empire State TAPPI Discusses Controls

The Hudson Valley Group of the Empire State Section of the Technical Association of the Pulp and Paper Industry met at the Queensbury Hotel, Glens Falls, N. Y. on Thursday evening, June 3, 1943. R. M. Drummond of the International Paper Company presided as chairman.

The principal speaker was A. E. Bachmann, vice president of the Missisquoi Corporation, Sheldon Springs, Vt. who discussed the Development of Production Controls in a Paper Mill. In this talk Mr. Bachmann pointed out that management is responsible for the control of production, quality, process, waste, and supplies. To attain the necessary end the following sequence should be observed: 1. record data (what, when, who, where, why); 2. Analyze data; 3. Specify procedure; 4. Assign responsibility; 5. Teach methods; 6. Develop standards; and 7. Appraise the results to note effectiveness.

Time and everlasting effort is required to establish controls. Much data must be accumulated and studied to determine the principles involved. Responsibility should be delegated to the individuals who are closest to the job involved. He should be furnished with complete information in a way that will insure his understanding of the results desired and such information should be made completely accessible.

Frank J. Lang of the Dexter Sulphite Pulp and Paper Company and Chairman of the Empire State Section and R. G. Macdonald, Secretary-Treasurer of TAPPI were present and made brief remarks. Lorenzi Garza and two associates from Mexico were introduced.

Those present included: G. J. Adams, A. E. Bachmann, R. P. Beaudette, E. H. Beazley, W. E. Beazley, L. Cline, M. Cline, A. B. Copping, H. J. Cronin, W. F. Curtis, F. L. Darrell, F. P. Doane, J. K. Donahue, R. M. Drummond, C. A. Duell, S. B. Duell, V. P. Edwardes, H. W. Fales, F. N. Foster, S. L. Foster, L. G. Gallup, L. Garza, M. B. Gormley, M. F. Hayes, E. T. Henning, C. C. Hopson, E. Hutchins, R. H. Jones, J. W. Joslyn, F. A. Juckett, A. Judson, F. J. Lang, A. A. Lowe, R. G. Macdonald, B. McCabe, F. J. McCourt, C. T. McGreen, W. J. Mandigo, F. I. Mason, H. L. Mellen, R. E. Neilson, H. S. Newell, F. Palmer, W. W. Putnam, C. S. Rankin, R. J. Robertson, L. T. Ross, R. A. Secord, J. F. Sheehy, C. V. Simmons, L. P. Thompson, R. A. Thomson, M. Wells, R. H. Wiles, and G. S. Witham.

Chemical Engineering Lab. Equipment

Chemical Engineering Laboratory Equipment by Zimmerman and Lavine has recently been published by the Industrial Research Service. It is a 530-page cloth-bound book, 6x9 inches with 163 illustrations and is intended for plant operators, research workers and students. Twenty-three university professors contributed to its preparation. Typical experiments and calculations reported cover friction factors for pipes and fittings, heat losses, drying rates, rates of absorption. Its main subjects include flow of fluids, flow of heat, evaporation, drying, gas absorption, filtration, crushing and grinding and distillation. Copies may be obtained from the Book Department of the Technical Association of the Pulp and Paper Industry, 122 East 42nd street, New York, N. Y., for $5.50 per copy.

New TAPPI Members

The executive committee of the Technical Association of the Pulp and Paper Industry has elected the following to membership:

Jules J. Becker, chemist—assistant plant superintendent, Equitable Paper Bag Company, Long Island City, N. Y., a 1940 graduate of N. Y. State College of Forestry, and formerly with the War Department, Jersey City, N. J.

Sebastian Bienfang, proprietor, Bienfang Paper Company, New York, N. Y.

Albert F. Bigelow, Jr., chemical engineer, American Coating Mills, Inc., Elkhart, Ind., a 1932 graduate of Armour Tech., and formerly with Lennon Wall Paper Co., Joliet, Ill.

Lothian M. Burgess, technical director, H. P. Smith Paper Company, Chicago, Ill., a 1929 graduate of North Dakota State College, and formerly with J. M. Huber, Inc., New York, N. Y.

Edward R. Chatterton, treasurer, E. W. Twitchell, Inc., Philadelphia, Pa.

Shepard Earll Church, Jr., student, N. Y. State College of Forestry, Syracuse, N. Y.

Tracy Cowen, technical director, General Felt Products, Inc., Brooklyn, N. Y., a 1926 graduate of Pratt Institute.

Frederic Dannerth, director, textile department, F. H. Levey Co., Inc., a 1906 graduate of University of Freiburg.

William B. Johnston, industrial fellow, Mellon Institute, Pittsburgh, Pa., a 1934 graduate of Cornell University, and formerly with American Cyanamid Company, Stamford, Conn.

Hubert E. Lloyd, chief chemist, The Ruberoid Company, New York, N. Y., a 1908 graduate of University of Wisconsin.

Frank J. Lovegren, personnel director and chief chemist, Inland Empire Paper Company, Millwood, Wash., has been transferred from the Associate to Active grade.

L. Louis Malm, sales manager, Swenson Evaporator Company, Harvey, Ill., a 1923 graduate of University of Colorado.

Joseph L. Owades, assistant chemist, Naval Clothing Depot, Paper Testing Laboratory, Brooklyn, N. Y., a 1939 graduate of C. C. N. Y., and formerly with Stanetal Corp., Elizabeth, N. J.

Kenneth L. Pike, vice president in charge of manufacturing, Single Service Containers, Inc., New York, N. Y., a 1930 graduate of Northeastern University, and formerly with Russell Box Company, Medford, Mass.

H. A. S. Read, Jr., vice president—manager of bag and liner department, c/o F. A. Read, Inc., Albion, N. Y., attended Lowell Textile School.

Samuel Rothenberg, student, N. Y. State College of Forestry, Syracuse, N. Y.

George V. Shaw, chief engineer, Pump Sales, Ingersoll Rand Company, New York, N. Y.

Leon M. Taylor, Chemist, Aetna Paper Company, Dayton, Ohio, attended University of Dayton.

David E. MacKnight, Chemist, Crane & Co., Inc., Dalton, Mass., attended Mackenzie College in Brazil and Columbia University.

Daniel M. Robbins, assistant to resident manager, Puget Sound Pulp and Timber Company, Bellingham, Wash., a 1938 graduate of Haverford College.

William P. Schulz, research chemist, The Barrett Division, Allied Chemical and Dye Corporation, New York, N. Y., a 1925 graduate of Cooper Union.

Joseph W. Shimp, Jr., graduate student, Institute of Paper Chemistry, Appleton, Wis., a 1940 graduate of Drexel Institute of Technology with an M. S. degree from the Institute of Paper Chemistry in 1942.

Harry W. Stevens, general sales manager and director of research, Benj. C. Betner Co., Devon, Penn., a 1925 graduate of Dartmouth College.

Karl F. Weikel, technical director, The United States Printing and Lithograph Company, Baltimore, Maryland, a 1933 graduate of U. S. Naval Academy.

George V. Thomson, Vice President and Secretary, the Cream of Wheat Corporation, Minneapolis, Minn., a 1916 graduate of Minnesota College.

Richard C. Williamson, manager, Technical Service Department, General Chemicals Division, Canadian Industries Limited, Montreal, Que., Canada, a 1931 graduate of the University of Toronto.

R. R. Ridgway Gets Schoellkopf Medal

Raymond R. Ridgway, associate director of research for Norton Company, Worcester, Mass., was awarded the Jacob F. Schoellkopf Medal for 1943 at the meeting of the Western New York Section of the American Chemical Society at Niagara Falls, N. Y. on May 20. Mr. Ridgway, who has his headquarters at Chippawa, Ontario, plant of Norton Company, is the thirteenth recipient of the Schoellkopf Medal which is awarded annually by the Western New York Section.

Mr. Ridgway has been with Norton Company since 1922 and is recognized as one of the outstanding research men in electrochemistry. His record contains a long list of inventions and improvements in the design of electric furnaces for the production of abrasives. His outstanding accomplishment was the isolation and commercial production of boron carbide, the hardest known material next to the diamond. Boron carbide is used extensively in abrasive form as a substitute for diamond dust in drilling and lapping carbide dies and tools. It is also made in molded form and, because of its exceptional resistance to wear, it is used in nozzles for sandblasting and in contact points for gages and measuring instruments.

Mr. Ridgway was born in Morris, Ill., August 27, 1897, and was graduated from Massachusetts State Institute of Technology in 1920.

Plastics for Greaseproofing

The use of tough, elastic plastics for greaseproofing paper is described in a new bulletin, "Polyvinyl Alcohol (PVA) For Greaseproof and Grease-Resistant Papers," issued by the Electrochemicals Department of E. I. du Pont de Nemours & Co.

Equipment, coating formulas and methods of application for greaseproof and grease-resistant coatings are described in detail in the new bulletin.

Polyvinyl alcohol coatings are highly resistant to all common oils and greases. They have a film strength superior to that of many materials now used for greaseproofing paper, and can be applied from hot or cold water solutions using conventional paper-coating equipment.

The bulletin is coded No. 1-1043, and copies may be secured from the Electrochemicals Department of the Du Pont Company, Wilmington, Del.

Metallographic Examination of Plant Equipment*

By Murray M. Rubin [1]

Abstract

The purpose of this paper is to stress the importance of metallography in industrial plant equipment utilization and conservation. A simple and inexpensive method for study of this subject in pulp and paper mills is presented briefly, together with a differential atlas of photomicrographs of normal and defective structures of metals and alloys employed in pulp and paper mills design, construction, maintenance, and operation. The practical application of important metallurgical principles, the relationship of microstructure to physical properties of cast ferrous and nonferrous metals and alloys, and surface treatment of metals is described in some detail. The effects of heat treatment on properties of metals as reflected in grain refinement, grain growth, hardening, toughening, normalizing, and annealing; and of mechanical work by rolling, forging, drawing, etc., are discussed. The trend toward utilization of important alloying elements is pointed out. Spectrographic and some nondestructive methods of examination (x ray and magnoflux) are mentioned, and the properties of several types of welded structures are explained. A comparison is made of the fundamental nature and microstructure of metallic and plastic bearing materials, and the importance of metallurgy in fourdrinier wire manufacture and technical control in paper machine operation for maximum wire life. It is hoped a better knowledge and more substantial visualization of the structure, properties, and functions of plant equipment for pulp- and papermaking will result therefrom and which will lead to more intelligent application and engineering uses of metals and possible substitutes in the pulp and paper industry.

Metallography may be defined as a science correlating the study of the internal and microstructure of metals and alloys with the physical and mechanical properties of these present day strategic and critical solid materials. It has always been an important division in the field of physical metallurgy, and of vital significance now in the national war program. This phase of mill engineering has been stressed mainly by equipment manufacturers allied with the pulp and paper industry, and largely neglected by both paper mill chemists and plant engineers. A broad knowledge of the optimum utilization of critical war metals and possible substitutes is a most important and effective means of conservation of such materials used in maintenance and economy of operation of pulp and paper mills. Besides stimulating a greater interest in this field by technologists in the paper industry, it is the purpose of this paper to:

1. present simple equipment and method for photomicrography of metals, plastics, paper surfaces, etc., at a cost which is within the reach of practically all paper mill laboratories
2. submit a differential atlas of normal and some defective structures of metals, plastics, wire cloth, etc., used in pulp and paper mill equipment, and which will serve as an essential and practical supplement to some of the present TAPPI Data Sheets (*1*) and Pulp and Paper Mill Catalogue (*2*).

* Presented at the Annual Meeting of the Technical Association of the Pulp & Paper Industry, Hotel Commodore, New York, N. Y., Feb. 15-18, 1943.

[1] Member TAPPI; Consulting Engineer, Springfield, Mass.

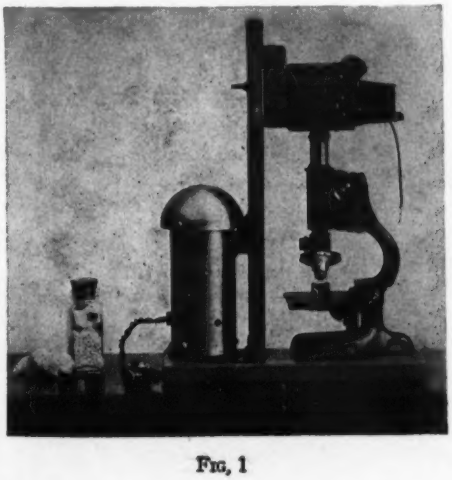


FIG. 1

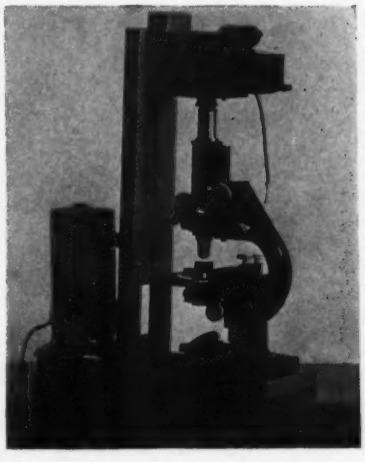
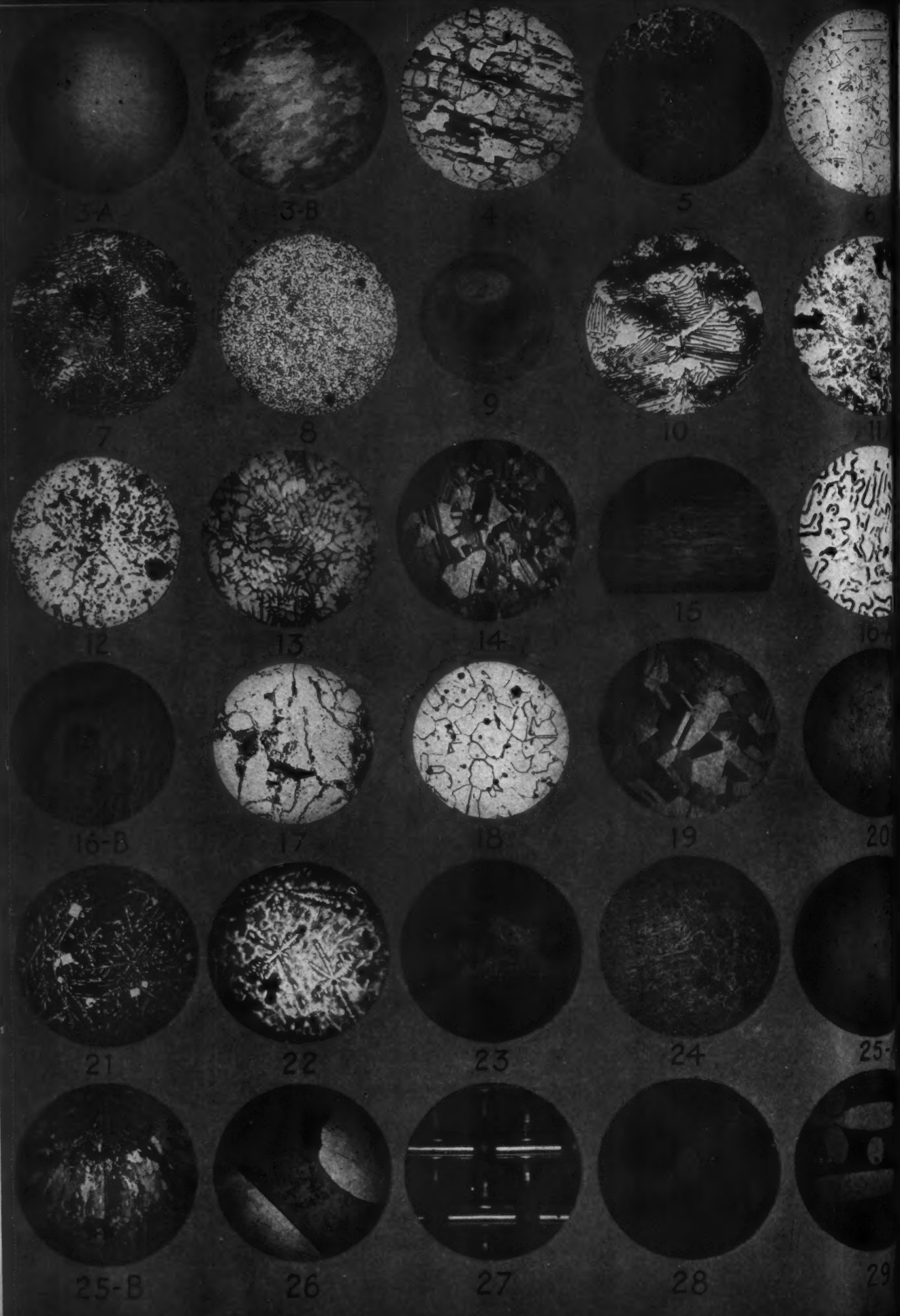


FIG. 2

Preparation and Examination of Metallurgical Specimens

Usually a sample of the material about ¾-inch square by ⅜-inch thick is required. A longitudinal, cross, or angular section is cut off with a hack or band saw, torch, or similar equipment depending on the nature of the material and information required by examination of the desired area in the final polished flat surface. Small samples, such as metal wires, and larger samples in which it is desirable to examine the edges or casing as compared to the center or interior of the metal specimen are mounted in plastics to facilitate polishing and handling of the sample.

The surface must be absolutely flat and free from


3-A
3-B
4
5
6
7
8
9
10
11
12
13
14
15
16
16-B
17
18
19
20
21
22
23
24
25
25-B
26
27
28
29

rough edges and burrs. This is accomplished by a rough grinding operation first by use of a flat power-driven horizontal belt covered with 1½ to 2/0 emery cloth as the abrasive. This is followed by intermediate and fine grinding operations performed by successively rubbing the prepared metal surface in one direction only on special fine grit emery papers backed by plate glass. The grit numbers of these abrasive papers range from 1, 0, 00, to 000. All traces of burrs and deep scratches in the metal surface are removed thereby. Next follows a wet polishing or lapping process. This consists of moving the metal surface back and forth with moderate pressure along the surface of a flat rotating disk covered with broadcloth and wet with water, and sometimes with a suspension of fine alumina or magnesia in water. This emulsion of abrasive powder and water acts as a lubricant between the cloth and metal surfaces, and repeated polishing of the metal surface yields a mirror finish free from all marks when examined under the microscope by vertical reflected illumination.

Metals and alloys are composed of crystals of characteristic fixed-grain size and arrangement, and these are revealed by properly etching the polished metal surface by rubbing or immersing in a suitable chemical reagent. The etched specimen is examined with a metallographic microscope, as shown in Fig. 1, at 100 or 300X magnification. For photomicrography with vertical illumination the writer has adapted the same reflex camera, roll film, and procedure as described in a previous publication *(3)*. The light source in this equipment is a 75-watt Mazda lamp placed in a vertical position in the receptacle shown behind the vertical illuminator of this microscope. In the foreground of Fig. 1, is shown a vertical illuminator attachment for quickly converting a paper mill microscope as shown in Fig. 2, to a metallographic microscope. The lamp housing in Fig. 2, was made from a socket of 3-inch diameter paper roll core. Photomicrographs in color were obtained by using *B*, photoflood 750-watt blue lamp, with variable resistance in the line, as the light source, Kodachrome film, and very short exposure time (½ second). For smaller color photos this camera was fitted with an adapter and filters to use roll film and with the regular 75-watt Mazda lamp. This micrometallographic equipment is compact, portable and of nominal cost. The usual magnification range for visual observation is 100 and 300X for the photos in this atlas, and which have been reduced one quarter for convenience in publication.

Some Properties of Strategic Metals and Alloys

The analytical table indicates 14 metallic elements and 4 nonmetallic elements of major importance and value in metals and alloys used in pulp and paper mills. The most important of the construction metals is iron. It alloys readily with several metals, advantageously with carbon and silicon and disadvantageously with sulphur, phosphorous, and oxygen. Combinations of iron and carbon yield various grades of plain carbon steels and cast irons. Silicon in small amounts up to 4.5% increases the strength of iron; up to 14.5% it gives materials of high resistance to acid corrosion, but very hard, brittle structures and poor in machinability. Combinations of small amounts of carbon with iron give plain carbon steels as indicated in an equilibrium diagram.

Copper, used alone as in mill pipes, or with zinc or tin as brass or bronze alloy in fourdrinnier wires is of the greatest importance. Copper is especially useful for fresh water and stock lines, since this metal has certain antiseptic qualities against water born microorganisms and assists thereby in keeping pipelines and stock free from slime. Brass alloys with more than 20% zinc are susceptible to a form of corrosion called dezincification, which leaves the brass in a porous condition. Otherwise, copper and its alloys can be welded, bolted, and easily worked in the mill.

Nickel is a silvery, very hard, ductile, and tenacious metal of great strength and resistance to attack by alkalies. It has the remarkable property that it can be welded to steel plate at rolling heats so that nickel-clad steel plate can be fabricated of 10% thickness of nickel and 90% steel. It is easily workable and can be welded in the mill. Besides, nickel has long been used to improve the quality and properties of steel. With iron, and chromium in amounts over 12%, it forms high-temperature, corrosion-resistant alloys such as stainless steel; and with copper forms Monel metal, which is a corrosion resistant alloy of great strength and durability.

Manganese is an important constituent as a deoxidizer in structural steels and hardener in alloy steels.

Molybdenum, like chromium, is highly resistant to acid corrosion and adds strength also when added in small amounts to alloy steels.

Aluminum has the advantage of light weight, great strength of its alloys, and lack of corrosion by dilute sulphuric acid or alum solutions in white water, but is easily attacked by caustic solutions, and HCl acid which render it of limited value in pulp mills.

Bearing Materials—Metallic and Plastic

Metallic alloys for plain and sleeve bearings, and ball and roller bearings are used widely in pulp and paper manufacturing machinery. Like rubber tires, metallic bearings are practically unobtainable now owing to shortage of critical war metals, and added attention must be paid to maintenance and operation of present metallic bearings and possible substitution of plastic and fibrous materials.

Bearing metals for plain and sleeve bearings are composed usually of alloys of copper, lead, tin, antimony, and zinc, and are known as white metal, babbitt metal, brass, phosphor-bronze, etc. Nearly all the babbitt or white metal alloys are made of lead, tin, and antimony. From a cost standpoint lead and zinc are cheapest, but lead is too soft to be used alone. Antimony and copper are higher in price, and tin normally the most expensive. Antimony added to lead increases the hardness and brittleness, and addition of tin yields a tougher alloy. Original babbitt metal contained copper (3.6%), tin (89.3%), antimony (7.1%) and possesses great antifrictional properties. It is used extensively as a lining for bearings, not only because of antifrictional qualities, but also because it is much cheaper than a machined box. In general, white metals are cheaper than red brass alloys and have a lower melting point, so that worn out bearings can be remelted easily and replaced. Also hard axles or shafting will operate more quietly for a longer time in a white metal than in a red brass bearing, and with less possibility of shaft scoring.

Several bronze-bearing metals, and especially phosphor bronze or deoxidized bronze, have good antifriction qualities and stand up well under heavy loads, high-speed shafts and severe usage in plain- and sleeve-type bearings. The chemical composition and

Fig. No.	Material or Type of Alloy	Mechanical Treatment Cold Rolled, %	Heat Treatment	Chemical Composition, %													
				Al	Sb	Cd	C	Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	Si
3	Ingot Iron	.....	.....	....	....	....	.013	....	....	99.9	....	....	.017	....	....	.005	Trace
4	Wrought Iron	.....	.....	....	....	....	.08	....	....	99.6	....	....	.08	....	....	.07	.15
5	Steel, SAE 1015	.....	Carburized 16 hrs. at 1725° F.	....	....	....	.15	....	....	....	....	....	.45	....	....	.018	.19
6	Stainless Steel SAE 30915	.....	.....	....	....	....	.09	19.0	....	....	....	....	.45	....	9.0	.025	.55
7	Steel, SAE 9260 annealed	.....	.....	....	....	....	.62	....	....	....	....	....	.75	....	....	.020	2.00
8	Cast Alloy Steel	.....	Cast heated to 1650° F. for 20 min. air quenced to 1200° F., reheated to 1400° F. for 1 hr., furnace cooled to 1000° F. in 1 hr.	....	....	....	1.5	.45	1.75	....	....	....	.70	....	....	....	1.00
9	Cast Steel Shaft	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
10	Gray Cast Iron—fine graphite	.....	.....	....	....	....	3.3	....	....	....	....	....	....	....	....	....	2.10
11	Malleable Cast Iron	.....	Heated at 1750° F. for 10 hrs., furnace cooled to 1400° F., then cooled slowly to 1300° F. 25 hr. furnace heat treatment, and then cooled in air.	....	....	....	2.50	....	....	....	....	....	....	.30	....	.20	1.10
12	"Z" Metal	.....	White cast iron annealed and cooled at a faster rate than used for making malleable cast iron.	....	....	....	2.50	....	....	....	....	....	....	.30	....	.20	1.10
																NONFERROUS	
13	Cast Yellow Brass	.....	.....	....	....	....	....	....	70.	....	....	....	....	....	....	....	....
14	Brass, worked and annealed	50% reduction by cold rolling	Annealed after cold rolling	....	....	....	....	....	70.	....	....	....	....	....	....	....	....
15	Brass Sheet worked	.....	.....	....	....	....	....	....	70.	....	....	....	....	....	....	....	....
16	Cast Red Brass	.....	.....	....	....	....	....	....	85.	....	5.	....	....	....	....	....	....
17	Aluminum Cast Alloy SAE 34	.....	.....	88.5	....	....	....	....	10.	1.2	....	.2	Trace	....	....	....	Trace
																NICKEL AND	
18	Nickel	.....	.....	....	....	....	.45	....	....	1.2	....	....	....	....	97.0	....	1.35

Ag	S	Sn	Zn	ETCH	REMARKS
....	.025	....	....	2% Nital	Surface examined is a longitudinal section at right angles to the rolled surface of a gate valve stem from sulphate pulp mill. The polished surface shows small black areas in the micro-structure due to holes or inclusions in the metal which have been rubbed out or torn out in the polishing operation. The fine scratches left from the polishing procedure are evident. Etching shows the grain boundaries clearly. Constituent present is ferrite. Due to cold mechanical working or rolling of this material the grains are distorted and elongated, not equi-axed. Light and dark luster grains appear due to difference of orientation of the etched grain surfaces. Those grains reflecting all the incident light rays through the microscope tube to the observer's eye have high luster.
....	.02	....	....	2% Nital	Longitudinal section—wrought iron. The slag fibers show up in the polished sample as long narrow dark areas running in almost parallel lines. At ×300 the granular, non-homogeneous structure of large slag fibers is evident. The etched sample shows the parallel lines of slag particles, uniform grains and distribution of ferrite.
....	.030	....	....	2% Nital	Transverse section of a gear carburized in solid carburizing material and cooled in the furnace (McQuaid Ehn Test). The hyper-eutectoid portion of the case in Fig. 5 shows fine cementite boundaries outlining pearlitic areas. The pearlite laminations are coarse, the grain size is large. This is a normal carburized steel. Carburizing has changed the composition of the outer portion from a hypo to a hypereutectoid steel. A ring of euctectoid is next to the case, and inside that is the hypoeuctectoid portion.
....	.025	....	....	Electrolytic etch in 10% oxalic acid sol.	Transverse section of a sulphite digester fitting in the annealed state. The polished sample shows black spots due to etching pits, but no inclusions. Electrolytic etching reveals the grain boundaries and twinning planes. This is an austenitic type stainless steel, can be hardened only by mechanical treatment (cold work), and not by heat treatment. It cannot be welded in the mill without heat treatment following, except in stainless steels containing suitable amounts of Columbium.
....	.025	....	....	2% Nital	Transverse section of silicon manganese steel coil spring in flat diaphragm screen. The polished sample shows pits due to rubbed out inclusions. There is no evidence in the etched sample that this is an alloy steel. Large per cent of Pearlite (dark area) and low per cent of Ferrite (about 5-10% white area) observed. Relative amounts of Pearlite = 73.75% and Ferrite = 26.25% from calculation from chemical composition. The discrepancy between the calculated and the actual amounts of Ferrite is due to shift of the eutectoid point to the left in this steel, which is due to the silicon and manganese in this *alloy steel*.
....	....	....	....	2% Nital	Transverse section of a centrifugal pump drive shaft. The polished sample showed small nodules of carbon, similar to temper carbon, but smaller in size. Compare with Figs. 11 and 12. Etching reveals spherodized cementite produced by the heat treatment.
....	....	....	....	.....	Dryer Felt guide roll shaft 1¼" diameter which shows fatigue or progressive failure in service on the paper machine. Note small cracks on the outer surface which penetrated gradually to the interior of the shafting. The dark smooth part of the shafting, produced by constant rubbing of the fractured surface, represents the part of the section which failed gradually or progressively over a long period of time; the smaller lighter colored granular area represents the sudden fracture. This was replaced by use of a tougher, more ductile alloy steel shafting. The value of X-rays, diffraction and gamma rays, radium, magnaflux and similar non-destriuctive methods of testing are of the greatest importance as established methods for examination of metals, welds, and prevention of such failures, but a discussion of these methods, and also powder metallurgy and spray metallizing processes, is beyond the scope of this publication.
....	....	....	....	2% Nital	Transverse section from a plunger pump piston. The polished sample shows only fine graphite flakes. Etching reveals areas of Pearlite, surrounded by Ferrite and tiny globules of Steadite. The finer graphite flakes are due to a more rapid cooling rate. Cast iron is suitable for piston rings, dryer rolls, etc., because this material is easily cast, readily machinable; sound castings produced of excellent surface finish at low cost.
....	.08	....	....	2% Nital	Transverse section of pipe fitting. Nodules of free carbon show in the polished sample. Etching shows the only metallographic constituents to be Ferrite and nodules of free carbon. No combined carbon present as cementite or pearlite, and no flake graphite as in Fig. 10. A more regular and continuous ferrite grain structure, produced by more complete transformation and less combined carbon present, results in a stronger and more ductile material.
....	.08	....	....	2% Nital	Transverse section of pulpwood conveyor chain belt. Temper carbon nodules show in the polished sample. Etching shows the ferrite grains and grain boundaries, with spherodized cementite centrally located in the ferrite grains. In this sample there is both free and combined carbon present; due to the faster rate of cooling in annealing, all the pearlite was not transformed to ferrite and temper carbon, and that in the grain center remained unchanged. This material is 25% stronger than good malleable iron and far more resistant to abrasion and corrosion. Compare Figs. 11 and 12.
METALS AND ALLOYS					
....	....	....	30.	Ammonia, water, and hydrogen peroxide	Section at right angle to surface of a pipe flange. The polished surface shows pits or inclusions. The etched surface shows large grains with a dendritic structure, and a non-homogeneous solid solution due to varying composition of the alpha brass constituents produced by rapid cooling in solidification. The dendritic structure is characteristic of quickly cooled metal.
....	....	....	30.	Ammonia, water, and hydrogen peroxide	Longitudinal section of bar slice. The etched surface shows much smaller grains than Fig. 13, grains irregular in size and shape, and occurrence of twinned grains. The cold rolling distorts and elongates the grains, making these non-equiaxed, and reduces the grain size. Annealing consists of heating above the recrystallization temperature and slowly cooling. Annealing increases the grain size, but dependent on temperature, time, and amount of cold rolling of the material.
....	....	....	30.	Ammonia, water, and hydrogen peroxide	Longitudinal section of rolled surface of sample of alpha brass sheet. Fig. 15—spring temper—section of slitter knife spring. Etched surface shows elongated grains. Fine parallel lines on the surface of sample of spring brass, due to work on the metal in rolling, indicate direction of lines of flow of the worked metal.
....	....	5.	5.	Ammonia, water, and hydrogen peroxide	Transverse section of a bronze journal bearing. This copper base casting alloy is easily machinable. The polished surface shows only the insoluble lead globules, as black spots. Note amount and distribution of lead. The cored dendritic structure shows up on etching. This is the copper rich phase. The insoluble lead globules are evident, and an intermetallic compound, delta A Bronze (Cu_4Sn), bluish in color is present in the cored solid solution in Fig. 16A. Fig. 16B—photomicrograph in color of cast red brass.
....	....	....	....	.5% Hydrofluoric Acid	Transverse section of fourdrinier tube roll. Due to difference in hardness of the constituents, structure is evident in the polished unetched surface. Dark areas are evident, as black spots, due to inclusions. Etching shows up the structure in greater detail. The large grains are Al rich solid solution, with a network of particles of the eutectic Cu Al_2 extending through this. Etching reveals structures like Chinese script, due to impurities of Ni Al_3, Al-Fe-Mn, and agglomerates of impurities of Fe, Mn, Si.
HIGH NICKEL ALLOY					
....	....	....	....	1/1 Conc. Nitric and glacial acetic acid mix.	Transverse section of evaporator tube for rayon grade caustic soda from pulp mill bleach liquor preparation plant. The polished surface shows many inclusions as dark spots. The etched sample shows grain boundaries distinctly and twinning of some grains. In a twin grain the atoms on one side of the plane are arranged in mirror image positions to atoms on the other side of the plane, and this can be confirmed by X-ray diffraction of the twins in a grain.

Fig. No.	Material or Type of Alloy	Mechanical Treatment Cold Rolled, %	Heat Treatment	Chemical Composition, % Al	Sb	Cd	C	Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni	P	Si
19	Nickel Alloy hard drawn and annealed	.....	Annealed 10 hr. at 1000° C.	....	....	....	....	....	....	....	....	....	4.5	....	94.5	....	1.
20	Inconnel cold rolled	20	.....	....	....	....	.07	13.48	.07	6.11	....	....	.19	....	79.86	....	.22
																	BEARING MATERIALS
21	High Copper Babbitt	.....	.....	....	7.5	....	....	....	7.5	....	....	....	....	....	....	....	....
22	Cadmium Silver Metal	.....	.....	....	....	96.2	....	....	.75	....	....	....	....	....	....	....	....
23	Composition Plastic Bearing	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
																	WELDS AND
24	Electric Arc Weld, Coated Electrode	.....	.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
25	Spot Weld Sheet Steel	.....		....	....	....	.07	....	....	....	....	....	.40	....	....	.025	....
26	Low temperature Silver Brazing Alloy	.....		....	....	....	....	....	80.	....	....	....	....	....	....	5.	....
27, 28, 29	Fourdrinier Wire Standard Weave	.....	Brass Shute Wire Phosphor Bronze Warp Wire	.... ..	....	....	....	....	80. 92.	....	....	....	....	....	....	3	....

microstructure of these bearing alloys is further indicated in Figs. 13-16, 21, 22. When a white metal bearing runs hot, the structure of the bearing alloy becomes more coarsely crystalline and its performance less favorable. Proper bearing design, construction maintenance, and operation is controlled easily by record of bearing temperature. Normally, bearing temperatures should not exceed 140-160° F. and are checked most easily by measuring temperature of the bearing lubricant with a thermometer.

Tool or alloy steel balls Fig. 8 are best for ball bearings. Ball and roller bearings are especially suitable for slow-running, heavily loaded bearings and are used in preference to sliding bearings for several reasons.

(a) Ball bearings much shorter and more compact than sliding bearings.
(b) No scraping and fitting of bearing linings.
(c) Negligible wear of ball and roller bearings.
(d) Less frictional starting resistance.
(e) Lower coefficient of friction and less loss of power.
(f) Danger of heated bearings practically eliminated.
(g) Self-adjustment of bearing to shaft deflections.

As indicated in Figs. 13-15, all metals are more or less plastic. However, synthetic plastic bearing materials have no such metallic composition and crystalline properties as described above. These are made from laminated resins or by impregnation of textile and paper with resin in liquid or solution state, but have a physical structure analagous to metallic bearing materials. The resin is of synthetic organic chemical origin, such as is formed by condensation in alkali or polymerization of formaldehyde or similar aldehydes reacting with phenol. The plastic sheets or impregnated fibrous materials are molded under heat and high pressure to produce dense, strong, tough, hard-surfaced material, resistant to corrosion, wear and abrasion, and have been used successfully for several years as a substitute for tin and copper-base metallic alloy bearing materials because of ability to withstand heavy and continuous loads. Fig. 23 shows the microstructure of such plastic bearing material to conform

Ag	S	Sn	Zn	ETCH	REMARKS
....	....	....	....	1/1 Conc. Nitric and glacial acetic acid mix.	Ni alloy for spark plug electrodes. Longitudinal section of a sample of 72 mil wire such as is used for the center electrode of automobile spark plugs. Grains still larger than annealing at 1000° C. for 1 hr. Twin grains evident. The grain size of an annealed material is determined by the following factors: 1. Composition of material 2. Temperature of annealing with reference to recrystallization temperature. Higher temperature gives larger grain size. 3. Time of annealing. Longer time results in larger grain size. 4. Amount of cold rolling. Cold work reduces the grain size.
....	.008	....	....	5% Sulphuric Acid, Electrolytic	Transverse section of circulating system heater tubes in sulphate pulp mill. The metallographic appearance of non-ferrous and ferrous alloys frequently shows little difference compared to the cast metals, plain cast iron, and plain carbon steels. A chemical analysis is indispensable as a guide here. Where small amounts of some metals are used in alloys, spectrographic (4) methods of analysis are quicker and more accurate than chemical methods. Rapid methods of differentiation of many well known alloys by spot tests are available too, which make complete chemical analyses unnecessary for practical identification by mill men. (5)
—METALLIC AND PLASTIC					
....	....	85.	....	2% Nital	Transverse section of a shaft bearing ¼" thick. The thin section and fast cooling result in small crystals in the metal structure here. The structures and hardening agents stand out in relief nicely by polishing only. Etching shows a dark matrix of tin rich solid solution and an eutectic. *A soft matrix and a small amount of hard constituent not easily worn down by abrasion is typical of the structure of bearing metals.* The hardening agents here are: Sb Sn—intermetallic compound—white cubic crystals Cu Sn—intermetallic compound—needles or star-liked aggregates This antifriction alloy has low frictional resistance and is frequently used to line bronze, steel, or aluminum alloy bushings. The size of crystals in a babbitt-lined bearing is dependent on composition of the babbitt, pouring temperature and cooling rate. Microscopical examination is of great value here in manufacturing control.
3.0	....	....	....	2% Chromic Acid and 1% Sulphuric Acid Mixture	Transverse section of high speed roll, *sprayed* alloy bearing by metalizing process. This alloy consists of two solid solutions and a eutectic as follows: Eutectic matrix composed of Cu Cd₃ and another Cd-Ag solid solution I Primary solid solution of Ag Cd, cored matrix showing in the etched material as an envelope of dark composition and surrounding II Second solid solution of small grains of light colored composition Ag Cd and light colored globules or masses Cd-Ag II is the wear resisting component of this bearing metal in the matrix of the eutectic and I.
....	....	....	....	.....	Longitudinal section of synthetic composition plastic used for Jordan or dryer roll bearing material. Composed of sheets of fibrous textile or paper impregnated with phenol formaldehyde condensation type of synthetic resin. Mesh of cloth used for impregnation = 34 x 38. Thickness of ½" of pressed plastic resin contains 30 parallel sheets of this cloth imbedded in the resin. The photomicrograph of the section shows the white wavy lines of textile fibers as the soft constituent imbedded in the dense hard matrix of synthetic resin. This bearing material lasted 4 to 5 times as long as bronze bearing material.
BRAZED STRUCTURES					
....	....	....	....	2% Nital	Fleetweld 5—electrode used to deposit a bead of weld metal on a mild steel plate flooring. The polished section across the weld shows inclusions in the plate metal, but no inclusions or blow holes in the weld metal. Etching shows the equiaxed fairly small grains in the unaffected plate metal. The plate metal heated to just over the critical range during welding is composed of very small grains, due to heating just over the transformation temperature, and formation of small grains in the austenitic region. The plate metal overheated during welding contains large grains produced by growth at high temperature in the austenitic region. Fig. 24. The weld metal exhibits a cast columnar structure. Fig. 24.
....	.040	....	....	2% Nital	Sheets of .036 rimming steel, hot reduced from slabs, pickled and then annealed in a protective atmosphere. The polished section shows evidence of porosity in the weld. This might be due to trapped or dissolved gases present during solidification of the molten metal. Fig. 25A. The etched section shows equiaxed grains in the metal sheets. Due to the heating of the metal above the critical temperature during welding, the grains are much larger near the weld. The weld metal shows a cast columnar structure indicating that it melted during the passage of the electric current. Fig. 25B.
15.	....	....	....	Ammonia, water and hydrogen peroxide	Transverse section across sheet copper brazed with low silver alloy in Vortraps header installation. Outstanding features of silver alloys for brazing are low working temperature (1300° F.), exceptional fluidity and penetration, small amount of alloy required, strength and ductility of joints, cost savings. This joint was stronger than the metals joined. This technique has found great favor in welding or brazing of fourdrinier wire seams instead of sewed seams, and is growing in popularity for mill piping joints equipment. This silver alloy brazing metal joint shows dendrites in the polished samples. The etching solution dissolves these dendrites and attacks the silver alloy, leaving a pitted structure. Note blow hole showing as dark spot in silver alloy in Fig. 26.
....	....	....	20.	.....	New fourdrinnier wire 48 x 72 mesh—Brass Shute and phosphor-bronze warp wires. Fig. 27. Worn fourdrinnier wire—same as above wire, but showing nature and extent of wear of shute and warp wires when removed from paper machine. Note little or no wear of brass shute wires on top or bottom side, slight wear of top bronze shute wires, and extensive wear of bottom bronze shute wires. Fig. 28—worn wire, bottom side. Fig. 29—This is a longitudinal section of the wire in Fig. 27, polished and etched. The brass shute wires show as long parallel strips with characteristic grain size of the brass shute as compared to the phosphor bronze wires shown in cross section in Fig. 29.
....	....	7.7	....	Ammonia, water and hydrogen peroxide	

to the general structural features of bearing materials described in Figs. 21, 22. There is a cellulose-fiber-base constituent, varying from a soft absorbent chemical wood fiber paper to vulcanized rag stock or heavy textile fabric and the amount and properties of this component can be varied and controlled. This material is imbedded in a hard, wear-resistant matrix of synthetic resin, whose chemical composition and physicial properties likewise can be varied and controlled to suit the use requirements of the finished product. Water, oil, and grease lubrication can be used with such synthetic plastic bearing materials. That no such change of crystalline microstructure, and properties as indicated in metallic bearing materials can occur in plastic bearing materials which run hot is obvious, yet the ingenious composition and structure of plastics with or without cellulose fibers indicate how it can function with superior results for bearing materials as well as many other uses in pulp and paper mill equipment and machinery. Recently, papers have been impregnated with synthetic resins, the sheets cut with wing shaped patterns, piled in layers and formed into laminated airplane wings, boat hulls, and even substitutes for metal alloy dies by heating at 300°F. at pressures as low as 250 p.s.i. In this way paper in laminated plastics is filling the gap in the shortage of critical metals and synthetic plastics essential for the war effort.

Fourdrinier Wire Cloth

One of the most essential parts of the equipment in pulp and paper manufacturing is metallic filter screen or fourdrinier wire cloth. Since no satisfactory substitute for this equipment and the few critical metals or alloys which compose it is available, a brief discussion of its properties and means of conservation is opportune here. While the larger wire weavers

supplying the paper mills draw and anneal their own metal wire, none of them manufacture the wire-metal alloy but purchase wire as their raw material. As indicated in the analytical data and photomicrographs of copper and nickel alloys above, the only alloys found suitable from practical and economy standpoints for filter screen or fourdrinier wire cloth manufacture are brass, phospher bronze, and Monel metal.

The wire properties of prime importance to the wire weaver are tensile strength, ductility, and weldability; but to the paper manufacturer the resistances to bending, abrasion, and corrosion as reflected in wire life are considered more significant. From a metallurgical standpoint these properties are all related to the metal alloy composition, drawing, and annealing schedule, and the metal grain size or microstructure. From the chemical or spectrochemical composition, and especially on examination of the microscopical grain size as shown in Figs. 13-16, 29 the paper technologist has a simple and quick method of checking on both the manufacturer of the wire-metal alloy and the weaver as to any differences in the quality and uniformity in the finished wire cloth. This method permits approximate estimate also of the original physical properties of the metal alloy even in a worn out piece of the cloth after removal from the paper machine. As indicated in Fig. 28 the sample required for such results can be small, and only the top of one knuckle of the wire cloth is required.

Shute wires are composed mostly of alpha brass, the copper content is usually 80% or more and with the trend toward use of low-tin bronze to insure sufficient ductility and strength even in the cloth filler. The desirable properties in all important tin bronzes are associated with the alpha crystals, and in which the equilibrium diagram of this alloy indicates the percentage of tin is less than 12%. The tin used in the copper alloy for phosphor-bronze warp wires ranges from 7 to 8.5%. The formation of any delta bronze (Cu_4Sn), described in Fig. 16A, by improper alloy cooling is highly detrimental; because this component is very brittle, and this is reflected definitely in the alloy ductility. Phosphorous is present usually in amounts of less than 1%. It forms extremely hard particles of Cu_3P, and while these are too brittle for use as bearings they form an excellent nonabrasive skeleton in the strong, tough bronze matrix of the metal structure and definitely promote wire life. Uneven heat penetration in annealing will result in poor distribution of the tin in the alloy. Also, poorly worked or annealed phosphor-bronze wire will yield some comparatively large crystals in the wire core and result in weakening of wire strength. The brass wire section in Fig. 29 represents cloth from a good run on this machine. The large grain size is compatible with correct composition, drawing, and annealing of the brass; the phosper-bronze wire shows much smaller grains but the correct microstructure for this material and use requirement. The surface of warp wires must be smooth. Shute wires in the cloth belt make no contact directly with the fourdrinier machine wet-end rolls, and so these wires may have slightly rough or etched surfaces. The worn wire cloth in Fig. 28 showed a thin protective coating externally composed of alumina, rosin size, colors, and clay filler. There was no evidence of any pitting or dezincification of brass shute or chemical corrosion of phosphor-bronze warp wires by acidity in paper machine white water. This is a factor which affects wire life markedly in some paper mills due to normal seasonal temperature changes of the mill raw water supply and ranging in the machine headbox from 47°F. in winter to 80°F. in summer.

While many wire failures are due to fatigue, seam failure, edge cracking, and chemical corrosion, the primary cause of wire-cloth failure in good operating practice in approximately half of all wires used is abrasion and wear of the warp-wire knuckles. Factors which promote wire abrasion are machine speed, varying stock conditions, flat box covers, and suction roll surfaces and vacuum, and wet-end operating equipment. The location of the maximum total wire stress is on the lower knuckles of the bronze warp when the wire cloth curves over the suction or breast roll on the paper machine. Figs. 27 and 28 indicates the nature and extent of wear of top and bottom of shute and warp wires. All the wear affecting fourdrinier wire life occurs in the bronze warp wires, and by far the major percentage of the inside or bottom side of the bronze warp knuckles.

The percentage wear is a function of the worn-knuckle length and area. Consider the worn elliptical surface area on the bottomside of the bronze warp knuckle in Fig. 28. The mathematical relationship of percentage wear of wire thickness is as follows:

L = axis of length
w = axis of width
$\frac{\pi L w}{4}$ = major worn area

t = thickness of worn wire at bottom center of worn knuckle
T = thickness of new warp wire
$\frac{T - t}{T}$ = percentage wear of wire thickness

Owing to flattening of 5-10% of the top and bottom warp knuckles, equivalent to wear, and produced in the weaving operation and breaking in of the cloth, the theoretical maximum wear in terms of the original wire strand diameter is only 90-80%, and in practice only about 70% before the wire cloth falls apart due to abrasive wear. A record of wire caliper and use of a speedometer or mileage counter connected to the wire roll journal are recommended to control progressive wire wear at the machine and detection and elimination of excessive abrasive wear.

Literature Cited and Bibliography

1. TAPPI Data Sheets—No. 7, Temperature Chart for Metals; No. 12A, 12B, Rolled and Forged Steel Recommendations; No. 13, Carbon Steel S.A.E. 1020 Water Quenched; No. 14, Carbon Steel S.A.E. 1040 Oil Quenched; No. 15, Nickel-chromium S.A.E. 3135 Oil Quenched; No. 16, 17, Chemical Composition of S.A.E. Steels; No. 39, Welding Electrode Requirements; and No. 57A-57F Identification of Metals and Alloys. Technical Association of the Pulp and Paper Industry, 122 E. 42nd St., New York, N. Y.
2. S.A.E. Standard Specifications for Different Steels—Pulp and Paper Mill Catalogue—Engineering Handbook, 1941 ed., p. 483.
3. Rubin, M. M., and Rubin, M. L., "Spots and Specks in Paper," *Paper Ind.* 21, No. 4:423-434 (1939).
4. Brode, W. R., "Chemical Spectroscopy," New York, John Wiley, 494 p. (1939).
   Twyman, F., "The Spectochemical Analysis of Metals and Alloys," New York, Chemical Publ., 355 p. (1941).
5. Williams, T. H., "Rapid Methods for Detection of Nickel in Alloy Steels," *Ind. Eng. Chem. Anal. Ed.* 14, No. 1:72-73 (Jan., 1942).
   "Qualitative Identification of Some Common White Metals and Alloys," Process Industries Quarterly 7, No. 1:7-8 New York, International Nickel Co. (1942).
6. Greaves, R. H., and Wrighton, H., "Practical Microscopical Metallography," New York, Chapman & Hall, 256 p. (1933).
7. Doan, G. E., "Principles of Physical Metallurgy," New York, McGraw-Hill, 332 p. (1935).
8. Heyer, R. H., "Engineering Physical Metallurgy," New York, D. VanNostrand, 549 p. (1939).
9. Jeffries, Z., and Archer, R. S., "The Science of Metals," New York, McGraw-Hill, 460 p. (1924).
10. Sauveur, A., "Metallography and Heat Treatment of Iron and Steel," Cambridge, Mass., University Press, 4th ed. (1935).
11. Williams, R. S., and Homerberg, V., "Principles of Metallography," New York, McGraw Hill, 4th ed. (1939).
12. Kehl, G. L., "Principles of Metallographic Laboratory Practice," New York, McGraw Hill, 1st ed. (1939).
13. St. John, A., and Isenburger, H. R., "Industrial Radiography," New York, John Wiley, 232 p. (1934).

Wood Pulp Production Declines

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., June 9, 1943—Receipts of wood pulp by U. S. paper mills during the first four months of 1943 were 22% below the receipts for the same period in 1942, and may decrease to 25% below by the end of the year, the War Production Board announced today. Paper production probably will decline in about the same proportion.

The decline in receipts of wood pulp is approximately in line with expectations of the Pulp and Paper Division of WPB, and has been taken into account in estimates of the future paper supplies.

The greatest decline in receipts of this essential material for paper making was in the Lake States region, where it amounted to 45%; the Pacific Northwest was second, with a decline of 30%; the Appalachian region declined 21%, the South 14%, and the Northwest, 8%.

Recent reports from Canada indicate that Canadian production of pulpwood has also suffered a severe reduction, the cut of pulpwood for consumption by Canadian mills for the year ending April 30, 1943, being substantially below that of the previous year. However, it is understood that Canada will deliver during the balance of the year the 1,550,000 cords previously promised to U. S. mills.

The factor primarily responsible for the decrease in pulpwood production, both in the United States and Canada, it was pointed out by the Pulp Section of WPB, is a shortage of labor in the woods. This labor shortage is affecting the production of all forest products, as evidenced by a decline in lumber production, chemical wood and cooperage stock.

It was the opinion of the Pulpwood Industry Advisory Committee, which is composed of representative producers from the major pulpwood regions, that the manpower shortage in the woods, and shortage of trucks, tires, and repair parts, will probably result in the decline in total U. S. receipts of pulpwood in 1943 by approximately 25% from those of last year.

The recent extension of the expiration date of "T" gasoline coupons to July 25, in thirteen eastern states, will reduce gasoline available for operating pulpwood trucks by about 40% and reduce wood pulp production in those states by about 32%, the advisory committee predicted. Suggestions and recommendations on pulpwood transportation, procurement of truck parts, replacement tires, and other problems were also made and will be communicated to the pulpwood industry by the WPB Pulp Section.

Paper Men to Hold Outing

PHILADELPHIA, Pa., June 7, 1943—The Philadelphia Paper and Cordage Association is ready for its annual outing at Llanerch Country Club on Thursday, June 17. This is the course where Bing Crosby and Bob Hope recently played in the interest of promoting sales for war bonds under the sponsorship of the Navy League . The outing is meant for every member, his employes and friends. There will be golf, quoits, games, dinner, show, prizes, fun galore . . . and free beer. Due to the food (and liquor) rationing, it will be necessary to have reservations in advance. Jack Culverhouse of Fort Howard Paper Company, Kinsley 2045 or Race 5121, is handling the reservations.

Starch Supply Situation Serious

A serious situation has developed regarding the supply of industrial starch in the future. Present stocks of corn in the hands of starch manufacturers are equivalent to less than thirty days' operations in some cases, and even less in other instances.

The cause of the situation is attributed to lack of shipping facilities, manpower shortage, overtaxed machinery and the floods in the midwest corn producing area.

The supply situation is further complicated by the ceiling price on corn and the demand for hogs. The government established a maximum price of $1.07 per bushel on corn, and the farmer can obtain $1.35 to $1.40 per bushel for corn by converting it into pork. This has left the grain markets bare of cash corn for the starch millers.

Opinion has been expressed in competent quarters that unless the government acts promptly to remedy this serious maladjustment, many important industrial plants will be hampered through lack of adequate supplies of starch and starch products.

A. E. McMaster To Be Financial Adviser

Appointment of A. E. McMaster of Vancouver, B. C., as a special assistant to the financial adviser of the munitions department is announced in Ottawa. Mr. McMaster was formerly vice-president and general manager of Powell River Company, newsprint and pulp manufacturers of Vancouver, B. C., and was associated with other timber and pulp enterprises in the Pacific Coast province.

In his earlier business career he was in the services of the Canadian Pacific and Grand Trunk Pacific Railways in various capacities, and was secretary-treasurer of Port Arthur Shipbuilding Company at Port Arthur.

In recent years he was engaged in research studies of the potentialities for industrial expansion in the Pacific Coast province, and currently has been associated with the government committees concerned with the disposal of Japanese properties in British Columbia.

Papermakers At Fort William Strike

FORT WILLIAM, Ont., June 7, 1943—Newsprint production at the plant at the Great Lakes Paper Company, Ltd., was at a standstill today.

Confirming the strike of the paper makers, company officials were unable to estimate the number of employes affected. The company normally employes about 800 men. They said operations in the sulphite mill were continuing.

No statement was forthcoming from either the company or paper makers' union on the reason for the strike, but no dispute over wages was reported.

The paper makers are members of the International Brotherhood of Paper Makers, A. F. of L.

Dismiss Pacific Mills Complaint

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., June 9, 1943—The Federal Trade Commission has dismissed without prejudice its complaint against Pacific Coast Paper Mills, Inc., Bellingham, Wash., which had been charged with misrepresentation in connection with the sale of toilet tissues and paper napkins.

New York Paper and Pulp Market Review

Strong Paper Market Continues to Reflect Essential Character of Major Paper Items—Chemical Pulp Market Strong, With Declining Production Expected to Continue—Roofing Rags Active.

Office of the PAPER TRADE JOURNAL.
Wednesday, June 9, 1943.

A strong paper market continues to reflect the essential character of major grades of paper and paper products, with deliveries lagging behind the heavy demand. Lack of labor and increasing transportation difficulties, also continue in the current reports received from many manufacturers' representatives, jobbers, and general paper merchants.

The index of general business activity for the week ended May 29 declined to 140.7, from 141.1 for the previous week, compared with 132.0 for the corresponding week last year. The index of paper board production was 156.5, compared with 157.9 for the previous week, and with 138.2 for the corresponding week last year.

Paper production for the week ended May 29 was estimated at 92.7%, compared with 91.4% for 1942, with 96.8% for 1941, with 87.6% for 1940, and with 74.2% for the corresponding week for 1939.

Paper board production for the week ended May 29 was 95.0%, compared with 77.0% for 1942, with 84.0% for 1941, with 75.0% for 1940, and with 57.0% for the corresponding week for 1939.

Reports by the War Production Board reflecting a possible decline of 25% in pulp available for papermaking this year, has served to strengthen the already active demand for all grades of paper. Prices are low and an upward adjustment by the OPA is widely expressed as required to effect a more equitable price structure.

Wood Pulp

Demand for all grades of chemical wood pulp continues to be reported as strong. The supply situation in bleached sulphite and in strong unbleached sulphite pulps is tight, with the news grade in a stronger position as mill demand increases for blending with the higher grades. Southern kraft pulp, all grades, are also in a strong market position.

Rags

Mill buying of colored cuttings continues to be reported steady and in good volume. Demand for new whites is relatively quiet. All prices are firm and unchanged. Demand for roofing rags is reported in some quarters as in excess of current supply, especially in old whites and blues.

Old Rope and Bagging

No important change in the old rope market has been reported this week. Demand for scrap bagging continues steady, in fair volume.

Old Waste Paper

The old waste paper market is firm. The OPA Amendment No. 4, to Maximum Price Regulation No. 30, which went into effect on May 27, established new higher maximum prices on old kraft corrugated boxes and on old corrugated boxes, which are a combination of jute and kraft boxes. Old 100% kraft boxes are now $35 per ton, and old corrugated boxes, $23 per ton, f.o.b. cars, New York.

Twine

Demand for most standard grades of hard and soft fiber twines continues heavy. No important change in this market has been reported at this date.

Rules on Net Weight of Casein

WASHINGTON, D. C., June 9, 1943—Maximum prices established for casein are based on net weight, and not on gross, the Office of Price Administration emphasizes.

The casein maximum prices are listed in Table A in Section 1351.1523 (b) of Maximum Price Regulation No. 289 (Dairy Products) and, like all other maximums in that table and in all of Amendment No. 8 to the regulation, are on the net weight basis, OPA said in an interpretative announcement.

In no case may the seller, who must supply the bag at his own expense, include its weight as part of the weight of the commodity sold.

E. H. Miller is Elected President

FORT WAYNE, Ind., June 7, 1943—E. H. Miller, of Fort Wayne, was elected president of the Hartford City Paper Company at a meeting of the directors at the offices of the company in Hartford City. Ray VanWinkle, of Hartford City, was elected executive vice-president. Other officers are secretary, Louis F. Niezer, and treasurer, Louis Fox, both of Fort Wayne.

Directors elected by the shareholders for the coming year were Mr. Miller, P. C. Dooley, Mr. Fox and Mr. Niezer, all of Fort Wayne, and Mr. VanWinkle, of Hartford City.

War Shipping Practices Revealed

How parcels for American war prisoners, heavy electrodes for Russia, plywood for Britain, food for the Allies, firebrick for Canada, surgical dressings for the U. S. Army and a number of other war items are protected for safe delivery is interestingly illustrated in the current issue of Acme Process News, No. 12. This 12 page house organ by the manufacturer of Acme Steelstrap should be helpful to every shipper whose products are transported to the fighting and production fronts. Acme Steel Company, 2840 Archer avenue, Chicago.

Fine Paper Men Hear New Regulations

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., June 7, 1943—Thirty-one fine paper merchants attended the open meeting held at the Hotel Copley Plaza June 2 by the Paper and Paper Products Branch of the Office of Price Administration to present and explain the new regulations governing merchants' sales of fine papers.

West Virginia Pulp and Paper Company

230 Park Ave.
New York

35 East Wacker Drive
Chicago

Public Ledger Building
Philadelphia, Pa.

503 Market St.
San Francisco, Cal.

Manufacturers of

ENGLISH FINISH SUPERCALENDERED MACHINE FINISHED BOOK and LITHOGRAPHIC PAPERS

Offset, Envelope, Bond, Writing, Mimeograph, Ledger, Eggshell, Cover and Music Papers, Index Bristol, Post Card and Label Papers

HIGH GRADE COATED BOOK

• • • •

KRAFT WRAPPING AND KRAFT ENVELOPE
KRAFT LINER BOARD
BLEACHED SULPHITE AND SODA PULP
BLEACHED AND UNBLEACHED KRAFT PULP

MILLS:

Mechanicville, New York
Luke, Maryland
Covington, Virginia
Tyrone, Pennsylvania
Williamsburg, Pennsylvania
Charleston, South Carolina

PRICE & PIERCE »»»»»»»ltd•

Wood Pulp & Paper Agents

60 East 42 Street
New York. N. Y.

UNITED PIGMENTS

Pure Titanium Dioxide

UNITANE-O

A brilliantly WHITE, pure, fine titanium dioxide possessing excellent . . .

- **OPACITY**
- **BRIGHTNESS**
- **DISPERSION**

Suitable for ALL types of paper ranging from thin printing papers and waxing tissues to coated book and magazine stocks.

UNITANE O—110 was especially developed for paper pigmentation. Its excellent dispersion in water promotes good retention and excellent sheet formation. As a component of the beater furnish, it produces *whiter* sheets of *great brilliance*, and superior printing qualities.

SAMPLES of UNITANE O-110 will be sent promptly upon request.

UNITED

UNITED COLOR AND PIGMENT CO.

DIVISION OF INTERCHEMICAL CORPORATION
NEWARK, NEW JERSEY
SALES OFFICES IN PRINCIPAL CITIES

MISCELLANEOUS MARKETS

Office of the PAPER TRADE JOURNAL.
Wednesday, June 9, 1943.

BLANC FIXE—Prices on blanc fixe are firm and continue unchanged at prevailing market levels. The pulp is currently quoted at $40 per ton in barrels, at works; the powder is offered at $60 per ton, f.o.b., works. Demand reported fair for the week.

BLEACHING POWDER—Prices on bleaching powder are firm. Current demand reported active. Bleaching powder is currently quoted at $2.50 per 100 pounds, in drums, at works.

CASEIN—OPA maximum prices on processed acid-precipitated casein are as follows: 100 bags or more, 21 cents per pound; 20 bags, 21¼ cents per pound; less than 20 bags, 21¾ cents per pound, f.o.b., shipping point.

CAUSTIC SODA—Prices on caustic soda are reported unchanged. Demand for the current week is reported active. Solid caustic soda is currently quoted at $2.30 per 100 pounds; flake and ground at $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—Quotations on china clay are firm and continue unchanged. Demand reported fair for the current week. Domestic filler clay is currently quoted at from $7.50 to $15 per ton; coating clay is quoted at from $12 to $22 per ton at mine. Imported clay is quoted at from $13 to $25 per long ton, ship side.

CHLORINE—Quotations on chlorine unchanged. Government demand for war use continues heavy. Supplies larger. Prices firm. Chlorine is currently quoted at from $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—Quotations on some grades of rosin are higher for the current week. "G" gum rosin is currently quoted at $3.56 per 100 pounds in barrels, Savannah. "FF" wood rosin is currently quoted at $3.47 per 100 pounds in barrels, New York. Seventy per cent gum rosin size is currently quoted at $3.75 per 100 pounds, f.o.b., works.

SALT CAKE—Prices on salt cake are firm. Demand reported moderate for the current week. Domestic salt cake is currently quoted at $15 per ton in bulk; chrome salt cake at $16 per ton. All prices in car lots, f.o.b., shipping point.

SODA ASH—Quotations on soda ash are firm and continue to conform to prevailing market quotations. Demand heavy. Quotations on soda ash in car lots, per 100 pounds, are as follows: in bulk, $.90; in paper bags, $1.05; and in barrels, $1.35.

STARCH—Prices on corn starch are unchanged for the current week. Supply situation critical. Pearl is currently quoted at $3.10 per 100 pounds; powdered starch at $3.20 per 100 pounds. All prices in bags, car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—Quotations on sulphate of alumina are firm. Supply more limited for the current week. The commercial grades are currently quoted at $1.15 per 100 pounds; iron free at from $1.75 to $1.85 per 100 pounds, in bags, car lots, f.o.b., works.

SULPHUR—Prices of sulphur are firm and continue to conform to prevailing market quotations. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby car lots are quoted at $18 per ton.

TALC—Quotations on talc are firm and continue unchanged at prevailing market prices. Domestic talc is currently quoted at from $16 to $21 per ton, at mills. No quotations on imported talc.

MARKET QUOTATIONS

All market quotations, excepting those otherwise designated as official OPA maximum prices, are based on the manufacturers' price level as of October 1-15, 1941; maximum wholesale prices are based on the merchants' maximum prices for stipulated quantities at a quoted price to all customers of a like class, as shown by the merchant's sales records of goods delivered during March, 1942. A merchant's price list in effect in March 1942, showing quotations of actual shipments, will establish the current maximum prices.

Paper

(Delivered New York)

News, per ton—

Roll, contract...	*$54.00	@	—
Sheets	62.00	"	—

* OPA Maximum Price.

Kraft—per cwt.—Carload Quantities Zone A, f.o.b. Mill

Superstandard Wrapping	*$5.25	@	—
No. 1 Wrapping...	*5.00	"	—
Standard Wrapping	*4.75	"	—
Standard Bag.....	*4.375	"	—

* OPA Manufacturers' Prices.

Tissues—Per Ream—Carlots

White No. 1.....	1.12½	"	—
White No. 1 M. G.	1.10	"	—
White No. 1½....	1.00	"	—
White No. 2.....	.90	"	—
Anti-Tarnish M.F..	1.20	"	—
Colored	—	"	—
Kraft	.95	"	—
Manila	.90	"	—

Toilet—1 M. Sheets—Per Case

Unbleached	4.25	"	—
Bleached	5.70	"	—
Unbl. Toilet, 1 M.	4.16	"	—
Bleached Toilet...	5.70	"	—

Paper Towels, Per Case—

Unbleached, Jr.....	2.60	"	—
Bleached, Jr.....	3.20	"	—

Manila—per cwt.—C. l. f. a.

No. 1 Jute.....	11.25	@	—
No. 1 Manila Wrapping, 35 lb.....	6.00	"	6.25
No. 2 Manila Wrapping, 35 lb.....	5.75	"	6.00

Boards, per ton—

News	*$48.00	@	—
Chip	*45.00	"	—
Sgl. Mla. Ll. Chip	*60.00	"	—
White Pat. Coated	*75.00	"	—
Kraft Liners 50 lb.	*63.00	"	—
Binders Boards....	84.00	"	116.00

* OPA Base Prices per 10 tons. Less than 10 tons but over 3 tons, add $2.50; three tons or less, add $5; regular 35-39 basis, add $5.; basis 40-49, add $2.50; basis 91-100, add $2.50; basis 101-120, add $5.

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

	Bonds		Ledgers
100% Rag Ext. No. 1	$39.10@$46.00		$40.25@$47.25
100% Rag	32.20 " 37.75		33.35 " 39.25
85% Rag	.... "		29.90 " 35.00
75% Rag	23.00 " 27.00		24.15 " 28.25
65% Rag	.... "		22.80 " 27.75
50% Rag	18.70 " 22.75		19.90 " 24.25
25% Rag	16.40 " 20.00		17.55 " 21.50

Colors $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items. Delivered in Zone 1:

	Bonds	Ledgers
No. 1..	$10.55@$12.75	$11.70@$14.25
No. 2..	9.65 " 11.75	10.80 " 13.25
No. 3..	9.20 " 11.25	10.35 " 12.50
No. 4..	8.90 " 10.75	10.05 " 12.25

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper. Delivered in Zone 1:

No. 1 Glossy Coated...	$13.65	@	$15.50
No. 2 Glossy Coated...	12.40	"	14.00
No. 3 Glossy Coated...	11.60	"	13.25
No. 4 Glossy Coated...	11.15	"	12.75
No. 1 Antique (watermarked)	10.25	"	11.75
No. 2 Offset.....	9.60	"	11.00
A Grade E. F.....	9.35	"	10.75
A Grade S. & S. C....	9.60	"	11.00
B Grade E. F.....	8.85	"	10.25
B Grade S. & S. C....	9.10	"	10.50
C Grade E. F.....	8.55	"	9.75
C Grade S. & S. C....	8.80	"	10.00
D Grade E. F.....	8.25	"	9.50
D Grade S. & S. C....	8.50	"	9.75

Ivory & India at $.50 cwt. extra.

Wood Pulp

OPA Maximum Prices and Canadian Manufacturers Prices, Less Freight to Destination.

Bl. Softwood Sulphite.....	$76.00
Unbl. Softwood Sulphite.	65.00@ 66.00
Bl. Hardwood Sulphite.....	73.50
Unbl. Hardwood Sulphite....	63.50
Bl. Mitscherlich.....	81.00
Unbl. Mitscherlich.....	72.00
N. Bleached Sulphate.....	86.00
S. Bleached Sulphate.....	79.00
N. Semi-Bleached Sulphate...	62.00
S. Semi-Bleached Sulphate....	75.00
N. Unbl. Sulphate.....	73.00
S. Unbl. Sulphate.....	63.50
Bl. Soda	66.00
Unbl. Soda	62.00
Groundwood	46.00

Transportation Allowances

Applying to Producers of Wet Wood Pulp.

	Below 50% Air Dry Weight
Northeast	$13.50
Lake Central	13.50
Southern	16.00
West Coast (in area).....	10.50
West Coast (out area).....	16.50

	50%-80% Air Dry Weight
Northeast	$11.50
Lake Central	11.50
Southern	14.00
West Coast (in area).....	9.50
West Coast (out area).....	15.50

Applying to Producers of Dry Wood Pulp.

	Above 80% Air Dry Weight
Northeast	$8.50
Lake Central	8.50
Southern	11.00
West Coast (in area).....	7.50
West Coast (out area).....	13.50

Should freight charges actually exceed these allowances, the difference may be added to the maximum prices.

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

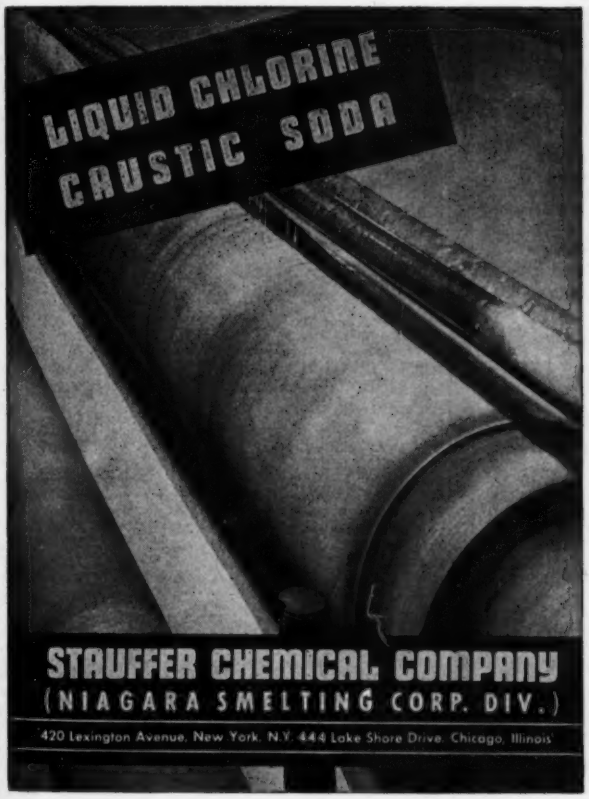
Shirt Cuttings—			
New White, No. 1..	6.50	@	7.25*
Silesias No. 1.....	—	"	5.75*
New Unbleached...	6.75	"	7.50*
Blue Overall.....	—	"	5.50*
Fancy	—	"	3.50*
Washables	—	"	3.00*
Bleached Khaki Cuttings	—	"	4.25*
Unbleached Khaki Cuttings	—	"	3.50*

* OPA Maximum Prices.

ENGLISH ECCO CLAYS CLAYS

UNIFORM • SUPERIOR • DEPENDABLE

English China Clays Sales Corporation
551 Fifth Avenue, New York City



STAUFFER CHEMICAL COMPANY
(NIAGARA SMELTING CORP. DIV.)
420 Lexington Avenue, New York, N.Y. 444 Lake Shore Drive, Chicago, Illinois

KOSMOS · DIXIE
PARIS
BLACKS

Carbon blacks with a high degree of miscibility especially adapted to the needs of the paper industry. Supplied uncompressed, semi-compressed or in bead form.

BLAC-KING 45 RX

An aqueous dispersion of Carbon Black with a solid content of 45%. Especially designed for use as a coloring agent for paper. Clean to handle and eliminates contamination of other colors in the beater room.

Samples and information on request

UNITED
CARBON COMPANY, Inc.
Charleston, W. Va.
New York • Akron • Chicago

Appleton Felts MAKE GOOD PAPER
APPLETON WOOLEN MILLS
APPLETON · WISCONSIN

MISCO "C"
THE CORROSION RESISTANT ALLOY
CAST • ROLLED • FABRICATED
for all equipment exposed to corrosion by sulphite acids
MICHIGAN STEEL CASTING CO., DETROIT, MICH.

LANGSTON
SLITTERS AND ROLL WINDERS
Maintenance costs are low because Langston's are soundly built from bed-plate up. You get firm, true rolls from all grades of paper or board.
SAMUEL M. LANGSTON COMPANY, Camden, New Jersey

Old Rags

White, No. 1—			
Repacked	*3.80	"	—
Miscellaneous	*3.20	"	—
White, No. 2—			
Repacked	*2.90	"	—
Miscellaneous	*2.65	"	—
Third and Blues—			
Repacked	*2.20	"	—
Miscellaneous	*1.80	"	—
Roofing Rags—			
No. 1	*1.55	"	—
No. 2	*1.45	"	—
No. 3 (bagging)	*1.35	"	—
No. 4	*1.35	"	—
No. 5A	*1.35	"	—
Old Manila Rope	5.75	"	—

OPA Maximum Prices.

Foreign Rags

All Prices nominal

New Rags

New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	"	2.20
New Light Silesias	5.50	"	5.75
Light Flannelettes	5.50	"	5.75
New White Cuttings	7.00	"	7.50
New Light Oxfords	4.00	"	4.50
New Light Prints	3.00	"	3.25

Old Rags

No. 1 White Linens	7.50	"	8.50
No. 2 White Linens	6.50	"	7.50
No. 3 White Linens	4.50	"	—
No. 4 White Linens	2.25	"	3.25
No. 1 White Cotton	4.25	"	4.75
No. 2 White Cotton	3.25	"	3.75
No. 3 White Cotton	2.50	"	3.00
No. 4 White Cotton	1.90	"	2.20
Extra Light Prints	2.00	"	2.40
Ord. Light Prints	1.75	"	2.15
Med. Light Prints	1.55	"	1.95
Dutch Blue Cottons	2.25	"	2.50
French Blue Linens	3.00	"	—
Checks and Blues	2.00	"	—
Linsey Garments	1.90	"	2.00
Dark Cottons	1.50	"	1.60
Old Shopperies	1.30	"	1.45
New Shopperies	1.45	"	1.50
French Blues	2.25	"	2.50

BAGGING

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	4.25	@	4.35
Wool Tares, light	4.25	"	4.50
Wool Tares heavy	4.50	"	5.00
Bright Bagging	4.50	"	4.85
Manila Rope—			
Foreign	—	"	—
Domestic	*5.75	"	—
Jute Threads	5.50	"	—
No. 1 Sisal Strings	*4.00	"	—
Mixed Strings	2.00	"	—

* OPA Maximum Price.

Old Waste Papers

(F. o. b. New York)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	@	—
No. 1 Hard White Envelope Cuts	3.12½	"	—
No. 1 Hard White Shavings, unruled	2.87½	"	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, one cut	2.87½	"	—
No. 1 Soft White Shavings	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Mixed Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
Mixed Groundwood Colored Shavings	.90	"	—
Overissue Magazines	1.67½	"	—
No. 1 Heavy Books & Magazines	1.57½	"	—
Mixed Books	.85	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Mixed Ledger, colored	1.87½	"	—
New Manila Envelope Cuttings, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
Extra Manilas	1.85	"	—
Mixed Kraft, Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
Triple Sorted, No. 1 Brown Soft Kraft	2.50	"	—
New 100% Kraft Corrugated Cuttings	2.25	"	—
No. 1 Assorted Old Kraft	1.75	"	—
New Jute Corrugated Cuttings	.90	"	—
Old 100% Kraft Corrugated Containers	1.75	"	—
Old Corrugated Containers	1.15	"	—
Box Board Cuttings	.72½	"	—
White Blank News	1.65	"	—
Overissue News	.85	"	—
No. 1 News	.75	"	—
No. 1 Mixed Paper	.70	"	—
Old Corrugated Containers	.82½	"	—
Mill Wrappers	.85	"	—

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.21	@	—
White Hemp	.21	"	—
Fine Polished—			
Fine India	.26	"	—
Unpolished—			
Box	.17¼	"	—
Paper Makers	.17	"	—
Tube Rope	.19	"	—
Wall Paper	.20½	"	—
Wrapping	.23	"	—
Soft Fiber Rope	.19	"	—
Cotton	.25	"	—

(Hard Fiber)

Medium Java	.18	"	—
Mex. Sisal	.16	"	—
Manila	—	"	—

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White No. 1	.07¼	@	.07½
New White No. 2	.04½	"	.05
Light Silesias	.04½	"	.04¾
Silesias, No. 1	.04	"	.04¼
Black Silesias, soft	.03¾	"	.04
New Unbleached	.07¼	"	.07½
Washable Prints	.03¾	"	.03½
Washable No. 1	.02	"	.02¼
Blue Overall	.04½	"	.05½
Cottons—According to grades—			
Washable shredding	—	"	.01¾
Fancy Percales	.03¼	"	.03½
New Black Soft	.02¾	"	.03
New Dark Seconds	1.75	"	2.00
Khaki Cuttings—			
No. 1 O. D.	.03	"	.03¼
No. 2 Mixed	.02¼	"	.02½
Corduroy	.01¾	"	.02¼
New Canvas	.04¾	"	.05¼
New Black Mixed	—	"	.02½

Domestic Rags (Old)

White No. 1—Repacked	3.80	"	—
White No. 2—Repacked	2.90	"	—
Miscellaneous No. 1	3.20	"	—
Miscellaneous No. 2	2.65	"	—
Thirds and Blues—			
Miscellaneous	1.80	"	—
Repacked	2.20	"	—
Black Stockings—			
(Export)	Nominal		
Roofing Stock—			
Foreign No. 1	Nominal		
Domestic No. 1	1.55	"	—
Domestic No. 2	1.45	"	—
Roofing Bagging	1.35	"	—
Old Manila Rope	5.75	"	—

Bagging

(F. o. b. Phila.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	3.00	"	3.50
Sisal Rope	3.75	"	—
Mixed	1.00	"	1.50
Scrap—			
No. 1	3.25	"	3.50
No. 2	1.75	"	1.80
Wool Tares, heavy	4.00	"	4.25
No. 1 New Light Burlap	3.00	"	4.00
New Burlap Cuttings	3.75	"	4.00

Old Papers

(F. o. b. Phila)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.87½	"	—
Soft White Shavings, one cut	2.50	"	—
White Blank News	1.65	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Ledger, colored	1.87½	"	—
No. 1 Heavy Books & Magazines	1.67½	"	—
Overissue Magazines	1.67½	"	—
New Manila Envelope Cuttings	2.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Box Board Cuttings	.72½	"	—
Kraft Corrugated Cuttings	2.25	"	—
Old Corrugated Containers	1.15	"	—
Overissue News	.85	"	—
No. 1 News	1.00	"	—

BOSTON

Old Papers

(F. o. b. Boston)

OPA Maximum Prices

No. 1 Hard White Shavings, unruled	2.87½	@	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
Hard White Envelope Cuts, one cut	3.37½	"	—
Triple Sorted No. 1 Brown Soft Kraft	2.50	"	—
Mixed Kraft Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
White Blank News	1.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Overissue News	.85	"	—
Box Board Cuttings	.72½	"	—
New Corrugated Cuttings, Kraft	2.25	"	—
Old 100% Kraft Corrugated Containers	1.75	"	—
Old Corrugated Containers	1.15	"	—
Jute Corrugated Cuttings	1.07½	"	—

Bagging

(F. o. b. Boston)

Gunny Bagging—			
Foreign	(nominal)		
Domestic	3.75	@	4.00
Sisal Rope No. 1	*4.75	"	—
Sisal Rope No. 2	*4.25	"	—
Mixed Rope	1.35	"	1.50
Transmission Rope—			
Foreign	(nominal)		
Domestic	2.75	"	3.00
Manila Rope—			
Foreign	(nominal)		
Domestic	5.75	"	—
Soft Jute Rope	4.50	"	5.00
Jute Carpet Threads	3.00	"	3.50
Bleachery Burlap	8.50	"	9.00
Scrap Burlap—			
Foreign	(nominal)		
Domestic	3.60	"	3.85
Wool Tares—			
Foreign	(nominal)		
Domestic	4.25	"	—
Aust. Wool Pouches	4.65	"	4.87½
New Burlap Cuttings	4.75	"	5.00
Heavy Baling Bagging	4.00	"	4.25
Paper Mill Bagging	2.50	"	3.00
No. 2 Bagging	1.35	"	—*

* OPA Maximum Price.

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.04½	@	.04¾
Fancy Percales	.04¼	"	.05
New White No 1	.06¾	"	.07
New Light Flannelettes	.05½	"	.06
Canton Flannels, Bleached	.06	"	.06½
Underwear Cutters, Bleached	.06¼	"	.06¾
Underwear Cutters, Unbleached	.05¾	"	.06
Silesias No. 1	.96	"	.06¼
New Black Silesias	.03	"	.03½
Red Cotton Cuttings	.03½	"	.04
Soft Unbleached Blue Cheviots	.06½	"	.06¾
Fancy	.05½	"	.06
Washable	.02¾	"	—
Khaki Cuttings	.02¾	"	.03
O. D. Khaki	.02½	"	.03¼
Corduroy	.03¼	"	.03½
New Canvas	.06¼	"	.06¾
B. V. D. Cuttings	.06¼	"	.06¾

Domestic Rags (Old)

(F. o. b. Boston)

White No. 1—			
Repacked	3.80	@	—*
Miscellaneous	3.20	"	—*
White No. 2—			
Miscellaneous	2.65	"	—*
Twbs and Blues, Repacked	2.20	"	—*
Old Blue Overalls	2.25	"	2.50
Thirds and Blues, Repacked	2.20	"	—*
Miscellaneous	1.80	"	—*
Black Stockings	3.50	"	4.00
Roofing Stock—			
No. 1	1.55	"	—*
No. 2	1.45	"	—*
No. 3	1.35	"	—*
No. 4	1.35	"	—*
No. 5, Quality A	1.35	"	—*
Quality B	1.20	"	—*
Quality C	.95	"	—*
* Old Manila Rope	5.75	"	—

* OPA Maximum Prices.

Foreign Rags

(F. o. b Boston)

Canvas	(nominal)
Dark Cottons	(nominal)
Dutch Blues	(nominal)
New Checks and Blues	(nominal)
Old Fustians	(nominal)
Old Linsey Garments	(nominal)
New Silesias	(nominal)

CHICAGO

Waste Paper

(F. o. b. Chicago)

OPA Maximum Prices.

Shavings—			
No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.87½	"	—
No. 1 Soft White Shavings	2.50	"	—
Misc.	2.15	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Ledger, colored	1.87½	"	—
No. 1 Heavy Books & Magazines	1.67½	"	—
Overissue Magazines	1.67½	"	—
New Manila Envelope Cuttings	2.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Box Board Cuttings	.72½	"	—
Kraft Corrugated Cuttings	2.25	"	—
Old Corrugated Containers	1.15	"	—
Overissue News	.85	"	—
No. 1 News	1.00	"	—

Bagging

(F. o. b. Chicago)

Gunny Bagging—			
Foreign	(nominal)		
Domestic	4.25	"	—
Aust. Wool Pouches	4.65	"	4.87½
New Burlap Cuttings	4.75	"	5.00
Heavy Baling Bagging	4.00	"	4.25
Paper Mill Bagging	2.50	"	3.00
No. 2 Bagging	1.35	"	—*

* OPA Maximum Price.

Domestic Rags (New)

(F. o. b. Chicago)

Shirt Cuttings—			
New Light Prints	.04½	@	.04¾
Fancy Percales	.04¼	"	.05
New White No 1	.06¾	"	.07
New Light Flannelettes	.05½	"	.06
Canton Flannels, Bleached	.06	"	.06½
Underwear Cutters, Bleached	.06¼	"	.06¾
Underwear Cutters, Unbleached	.05¾	"	.06
Silesias No. 1	.96	"	.06¼
New Black Silesias	.03	"	.03½
Red Cotton Cuttings	.03½	"	.04
Soft Unbleached Blue Cheviots	.06½	"	.06¾
Fancy	.05½	"	.06
Washable	.02¾	"	—
Khaki Cuttings	.02¾	"	.03
O. D. Khaki	.03½	"	.03¾
Corduroy	.03¼	"	.03½
New Canvas	.06¼	"	.06¾
B. V. D. Cuttings	.06¼	"	.06¾

Domestic Rags (Old)

(F. o. b. Chicago)

White No. 1—			
Repacked	3.80	@	—*
Miscellaneous	3.20	"	—*
White No. 2—			
Miscellaneous	2.65	"	—*
Twbs and Blues, Repacked	2.20	"	—*
Old Blue Overalls	2.25	"	2.50
Thirds and Blues, Repacked	2.20	"	—*
Miscellaneous	1.80	"	—*
Black Stockings	3.50	"	4.00
Roofing Stock—			
No. 1	1.55	"	—*
No. 2	1.45	"	—*
No. 3	1.35	"	—*
No. 4	1.35	"	—*
No. 5, Quality A	1.35	"	—*
Quality B	1.20	"	—*
Quality C	.95	"	—*
* Old Manila Rope	5.75	"	—

* OPA Maximum Prices.

Foreign Rags

(F. o. b Chicago)

Canvas	(nominal)
Dark Cottons	(nominal)
Dutch Blues	(nominal)
New Checks and Blues	(nominal)
Old Fustians	(nominal)
Old Linsey Garments	(nominal)
New Silesias	(nominal)
No. 1 White Ledger	2.17½ " —
No. 1 Heavy Books & Magazines	1.67½ " —
White Blank News	1.65 " —
Mixed Kraft Env. & Bag Cuttings	2.75 " —
No. 1 Assorted Old Kraft	1.75 " —
Overissue News	.85 " —
No. 1 News	.75 " —
No. 1 Mixed Paper	.70 " —
No. 1 Roofing Rags	1.55 " —
No. 1 Roofing Bags	1.45 " —